AY

Stopping Radio Howls—page 835

N.S.E.

25 CENTS

POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU

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EE PAGE 712

70,000 JOBS YEARLY for Tractor, Electric and Auto Experts

"70,000 men were put to work last year as mechanics and a large percentage of them knew no more about an automobile than does the average owner," says James M. Cleary of the Studebaker Corporation. He adds: "At $50.00 per job 400,000 car owners each day give their cars into the hands of mechanics for repairs and there is no way of estimating how many of these 400,000 mechanics know how to fix their cars satisfactorily."

8 Weeks TRAINING FITS YOU FOR A BIG PAY JOB

Read, READ—at the left—what a prominent *Studebaker* executive says. No wonder automobile manufacturers and 20,000,000 car owners are tearing their hair and pleading—"Give us more trained auto experts—quick." Deliver us from the untaught, half-baked "mechanics" who are working millions of dollars damage to our cars DAILY because they don't know their business.

In only 8 weeks I will train you to fill one of the 70,000 Big Money jobs that will be open this year.

Your Money Back GUARANTEED

This is the most daring offer ever made. I take all the risk. If at the end of your eight weeks' instruction in my school you are not perfectly satisfied with your training—if you have not learned to make repairs to autos, tractors, trucks and busses, I will hand back every dollar you have paid me. You can't lose.

"I wouldn't take $10,000.00 for what I learned at your school. I haven't had a job yet that looked hard to me."
G. F. STUMP AUTO SALES AGENCY
by G. F. Stump
Stone, Ky.

I Pay Your Railroad Fare Myself

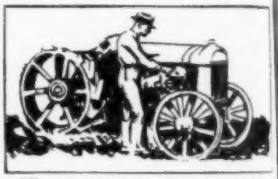
While my Special Reduced Price Training Offer lasts, I will pay railroad fare to Cincinnati. My course teaches you more in 8 weeks than you would learn in 4 years as a "handy man" around a garage.

"No more farming for me. I'm leaving for British Honduras where I am to get my board and clothes free and a salary of $300.00 per month on a two years contract. Your training did it."
HERBERT PIERSON, Taswell, Tenn.

Don't Work for Boys WAGES—$150.00 WEEKLY

I have taught thousands.

I can teach you. No schooling required. Get into Business for Yourself! Own a garage and make profits of $5,000.00 a year upward. My graduates are doing it in all parts of the country.



"Have just sent one of my friends to your school. Am doing fine myself, making $300.00 every month. Thanks to you."
J. L. JOHNSON
Benham, Ky.

"As a good carpenter I used to work for $1.25 per hour. Last year, after taking your eight weeks course, I earned $5200.00."
BOYD W. DAVISON
Endicott, N. Y.

Learn With Real Tools
on Real Equipment

No text books to study. You learn by doing actual work—easy, interesting, fascinating. Why waste four years at small wages as an apprentice to learn some other trade, when you can earn a "journeyman's" pay in the Auto business in only 8 weeks? No union to join—No "card" required to get a steady job

FREE

Get My Big 64-Page Book and Special Reduced Price Training Offer NOW.

All I ask is the chance to prove to you every statement made in this advertisement. Get your feet under you jump out of the ditch up onto the smooth, easy-to-travel Success highway. Send the coupon TODAY sure.

For every nickel or dime of profit that a man has made by delaying and waiting others have made thousands of dollars by their ability to make up their minds and to act quickly—before the opportunity was GONE! Do I need to say more?

Mc Sweeny Auto, Tractor and Electrical School, Dept. 140-A, Cincinnati, Ohio

Without any obligation send me your big free book on Autos, and your Special Short-Time Reduced Price Training Offer.

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McSWEENY AUTO, TRACTOR AND ELECTRICAL SCHOOLS

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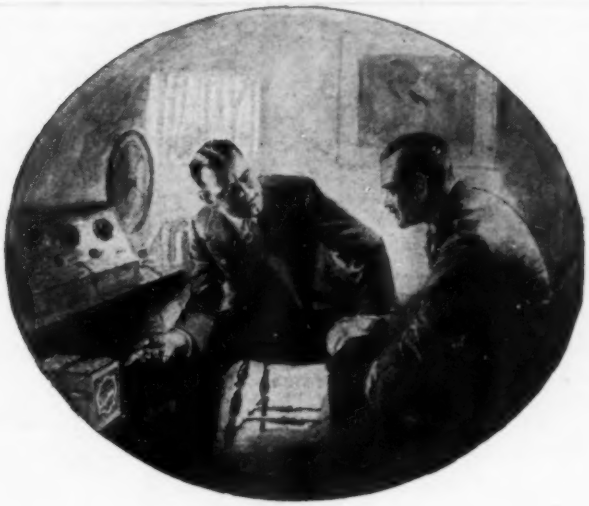


"The little wrinkle that makes my 'B' batteries last longer is using the right size Eveready with a 'C' battery"

"I USED to think that because the Eveready 'B' Battery No. 772 cost less than either of the larger Heavy Duty Evereadys that I was saving money. As a matter of fact, on four or five tube sets, that was false economy.

"The right size Eveready 'B' Batteries to use depends on the number of tubes in your set. The life of the batteries depends on how much you listen in and on whether a 'C' battery is employed."

To get the maximum of "B" battery life and satisfaction, follow these simple rules:

On 1 to 3 tubes—Use Eveready No. 772.
On 4 or more tubes—Use the Heavy Duty "B" Batteries, either No. 770, or the even longer-lived Eveready Layerbilt No. 486.
On all but single tube sets—Use a "C" battery.*

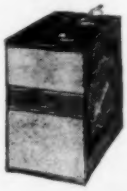
Follow these rules, and No. 772, on 1 to 3 tube sets, will last a year or more; Heavy Duties, on sets of 4 or more tubes, eight months or longer.

The average year-round use of a set is two hours a day. If you listen longer, your "B" batteries will have a somewhat shorter life. If you listen less, they will last longer.

Our new booklet, "Choosing and Using the Right Radio Batteries," is free for the asking. It also tells about the proper battery equipment for the new power tubes.

Manufactured and guaranteed by
NATIONAL CARBON CO., INC.
New York San Francisco
Canadian National Carbon Co., Limited, Toronto, Ontario

*NOTE: A "C" battery greatly increases the life of your "B" batteries and gives a quality of reception unobtainable without it. Radio sets may easily be changed to permit the use of a "C" battery by any competent radio service man.



LEFT—*No. 486, for 4, 5 or more tubes.* $5.50.

RIGHT—*Eveready Dry Cell Radio "A" Battery, 1½ volts.*

EVEREADY
Radio Batteries
-they last longer

Tuesday night means Eveready Hour—9 P. M., Eastern Standard Time, through the following stations:

WEAF—*New York* WBAI—*Cincinnati*
WJAR—*Providence* WEAR—*Cleveland*
WEEI—*Boston* WWJ—*Detroit*
WTAG—*Worcester* WGN—*Chicago*
WFI—*Philadelphia* WOC—*Davenport*
WGR—*Buffalo* WCCO { *Minneapolis* / *St. Paul*
WCAE—*Pittsburgh*
KSD—*St. Louis*

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Artist's Drawing of Some of the Far-Traveling Butterflies and Dragon Flies Which Nightly Visit Ships Miles off the Shores of Tropical Islands, Attracted by the Glowing Lights—See Page 741

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WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 45 MAY, 1926 No. 5

Radio Pen Draws Pictures from the Air

Attachment, Plugged In in Place of Loud Speaker, Converts Radio Set into Receiver for Broadcast Pictures

AN attachment which turns the voice of the receiving set into the skilled hand of an artist is the latest development from the laboratory of C. Francis Jenkins, inventor of the radio movies and a process for transmitting photographs through the air.

The new device—the radio pen—does not require any special receiving equipment, but plugs into the loud-speaker jack of any receiver and its range is limited only by the power of the transmitting apparatus in the broadcasting station. The pen outfit is not much larger than a loud speaker, being contained in a box eighteen inches square and eight inches deep.

Cartoons, maps, pen sketches, writing, anything, in fact, that can be reproduced satisfactorily in pen and ink, may be transmitted. At the sending end, the radio-pen transmitter is another small box, which can be plugged in on any existing broadcasting set, without changing the apparatus, so that the broadcaster can alternate between voice or music and pictures.

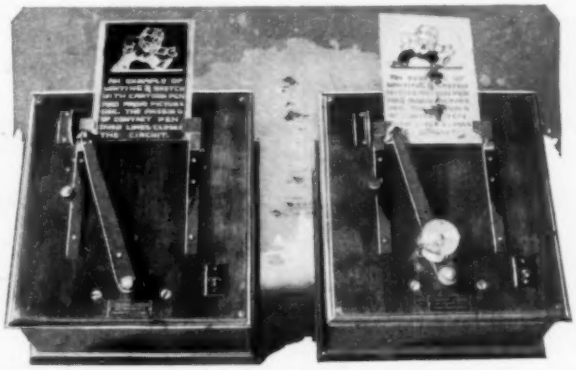
The sketch or cartoon to be transmitted is placed on top of the box containing the transmitting apparatus, and beneath the metallic transmitting arm, which sweeps back and forth across it, making and breaking the current. The original sketch itself can be used, or an electrotype or zinc etching, such as is used in reproducing the illustrations in a newspaper or magazine.

The receiving pen is much like that at the transmitting end, except that it may be equipped with a self-inking pen at the end of the six-inch arm, so as to reproduce the drawing in ink.

The system of motors and electrical connections is such that the two pens work in unison, like the arms of a pantograph, except that they may be separated by miles of space. When the arm at the sending end is depressed and swept across a line of the drawing, the radio signals, broadcast and picked up at the receiving end, cause a corresponding movement of the receiver pen.

The pen opens a new field not covered by the previous devices for transmitting pictures. It sends from a flat surface, and receives and draws on another flat surface, whereas the photograph transmitters, employing delicate and highly sensitive photoelectric cells, must necessarily employ either rolled films or a complicated system of expensive prisms to get the same result.

"We believe that this pen-and-ink machine has vast possibilities in the military field," declared Capt. R. W. McNeely, chief of the radio division of the bureau of engineering, U. S. navy, who watched the first demonstration, when a series of pictures were broadcast from the naval station at Anacostia, D. C., and picked up in the Jenkins laboratory. "We are cooperating," he continued, "with Mr. Jenkins to the fullest extent in developing these machines for war purposes. Just now we are blocked from taking over the invention outright because of lack of appropriations, which is regrettable, but we nevertheless intend to keep in close touch with the future



The Radio-Pen Transmitter, at Left, Sending from an Ordinary Engraving, and the Receiver, at the Right, Reproducing on Paper

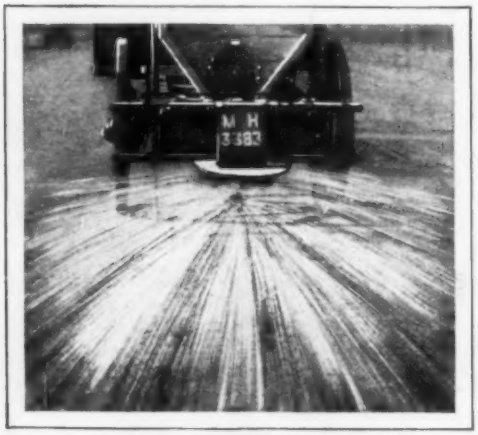
C. Francis Jenkins, Inventor of the Radio Pen, Seated at His Receiving Set While the Apparatus Reproduces a Drawing Broadcast from a Distant Station, and, Inset, the Drawing, Showing the Pen-Made Lines

development work. The transmission of code messages, the sending of maps showing the location of enemy fortifications, machine-gun nests and transmission of written orders, with signatures in facsimile to prevent forgery, are only some of the uses that may be possible in war time."

For public use the radio pen may hold infinite possibilities. With it the bedtime story could be illustrated with appropriate drawings, and daily cartoons transmitted direct to the listeners.

ROADS SPRINKLED WITH SAND FOR INCREASED SAFETY

After rains on one of the motor roads near London, a sand sprinkler is pressed into service to give the pavement a safety coating to reduce accidents. The material is distributed from a revolving drum at the rear of the truck and is thrown on both sides to a total distance right and left equal to the width of the driveway.



Sand-Sprayer in Operation on Pavement

BIG DREADNAUGHTS OF THE AIR TO CARRY TWENTY-FIVE GUNS

Construction of two 6,000,000-cubic-foot rigid airships, each to be equipped with twenty-five machine guns for combating attacks from airplanes, is planned by the United States navy. Seven of the guns will be of the new 50-caliber type and eighteen of 30-caliber. The weapons are to be so placed that concentration of fire will be possible in any direction or angle, according to Rear Admiral William A. Moffett, and the big ships will rely upon the non-inflammability of helium gas rather than on armor for protection from hostile planes. Already, it is said, the introduction of helium has necessitated revision of aviation tactics, for a ship so inflated cannot be exploded or easily set on fire. Even if the bags should be riddled by bullet holes, it is estimated that hours

would be required to bring the craft to the ground through gas leakage. "The present contemplated, but untried tactics of airplanes against helium-inflated rigids call for the former to get above the airship and bomb her with light demolition bombs," Admiral Moffett explains. "A light plane, moving at the rate of 150 miles an hour is not conducive to accurate bombing. It takes twenty-eight seconds for a bomb to drop from 12,000 feet. An error of one-half of one degree from vertical of a bomb sight causes an error of over 100 feet in aim. During the period of the bomb's fall, if from 12,000 feet, a rigid moves one-half mile on her course. The airship can bring her one-pounder, four 50-caliber and five double-mount 30-caliber guns to bear on the attacking plane or planes. It is not conceivable that success is possible against such a volume of fire." An airship of 6,500,000-cubic-feet-capacity, plans for which already have been drawn, used as an aerial transport could carry 750 men with individual fighting equipment 500 miles at a speed of eighty-five miles an hour and retain fifty per cent of its fuel reserve, it is estimated.

WOMAN'S FOLDING FIRE ESCAPE LOWERS BY ELECTRICITY

Devised by a woman seventy years old, an automatic fire escape is intended to be fastened to the roof of a building and lowered past the windows simply by pressing a button. When not in use, it lies folded up under a protective covering. Pressing the button, raises an arm which lifts part of the ladder, allowing the rungs to fall over the cornice. The rest unhinge and follow, dropping close to the sidewalk. Being shielded from the weather when not in use, the escape is less liable to wear out, and since it is out of sight, it removes one of the objections to the present types of equipment—that of disfiguring the exterior of an otherwise attractive building.

Women Inventor with Model of Fire Escape

ROPE-WALK AND AQUAPLANING MEASURE MENTALITY

A keen intellect is useful even in walking a tight rope, according to tests with students at Denver university. Fifty-six volunteered to walk across a tight wire, thirty-three feet long, while observers checked their performance. It was found that those of superior mentality had less difficulty, their muscles were better co-ordinated, enabling them to replace useless, false movements with skilled ones more quickly. Learning to balance is easier when fear is eliminated, the experiments showed. Students required fifty trials before they could walk across a rope stretched six feet above a mat on the gymnasium floor, but another group needed only thirty-eight trials when the rope was placed at three feet. It was also discovered that, when once the art of walking the rope was learned, it was not easily forgotten. Men came back after an absence of one or two years and walked the rope successfully at their first trial. Involving much of the skill required in keeping the balance on a wire, a ball game played on aquaplanes has proved a keen test for steady nerves. The planes are towed at the rate of thirty miles an hour behind a motorboat. Without using the customary hand ropes for support, the players toss a heavy cage ball back and forth while speeding over the waves, keeping their balance wholly by movements of their bodies.

© U. & U.
Playing Ball While Surf Riding, a Difficult and Thrilling Sport Requiring Skill at Balancing

FIGHTING FIRES IN SKY REQUIRES NEW TOOLS

© Henry Miller

Huge Extension Ladder, Recently Added to the Equipment of the Berlin Fire Department, Being Tested Out before the Cathedral

Following a fire to the upper floors of a lofty building, or the tall steeple of a great cathedral has introduced new methods and new equipment for fire departments. Skyscraper fires, such as a recent blaze in the great Equitable building in New York, are a distinctly American danger, but Europe has its own problems in her famous cathedrals. The Berlin fire department recently acquired a motor-driven extension ladder, seventy-eight feet high, able to support the weight of a fireman at its tip while he directs a stream of water. These motor-driven ladders have simplified the task of fire fighting above the ground. With ordinary ladders placed against the building, the fireman frequently is driven back by the intense heat when he comes in close contact with a window opening. As the motor ladders are supported by the truck base, they can be raised across the street, if necessary, and a powerful stream shot into the blaze while the fireman works in comparative comfort. The Equitable building fire was unusual in that it started in a shaft at one of the lower floors and sped upward, feeding mainly on electric-wire insulation, to break out into the building at widely separated floors. The worst damage occurred well above the thirtieth floor, more than 200 feet above the street. Firemen rode to the fire on the building elevators, and used the standpipes and fire equipment built into the building.

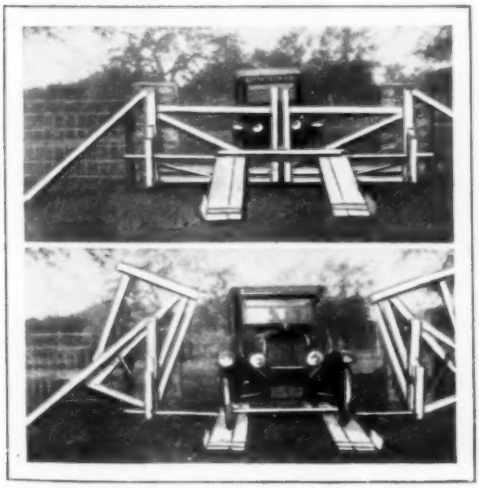
SEED AND PLANT TRAVEL AIDED BY AUTOMOBILE

Study of the travel habits of seeds and plants by Dr. H. A. Gleason, curator of the New York botanical garden, has revealed that nearly 700 alien species are growing near that city and similarly large numbers are to be found in the vicinity of almost every thickly populated center. Commerce has greatly aided the world flight of plants, hundreds of species traveling about in ships, freight cars and automobiles. A vessel takes on a load of earth as ballast and dumps it in a foreign port. If the climate is favorable, the seeds grow and plants distribute themselves by natural means. Shipments of hay, straw used for packing, or consignments of clover and other seeds contain foreign seed ready to take root in almost any environment to which they are delivered. The natural methods of distribution are varied and often effective. The witch hazel, for instance, develops two hard black seeds at the ends of the pods and, when these dry, they squeeze the seeds until they are shot forth like small bullets, sometimes as far as forty feet. Others are blown through the air with the aid of tiny hairs or "sails" and some are so small that they travel like dust. Among these are orchid seeds of which it takes 7,000,000 to weigh an ounce. Birds and other ani-

mals help distribute plant life, while ocean currents bear seeds and fruits to great distances. One of the commonest travelers is the dandelion. It originated in Europe, but has now spread throughout the United States; the American prickly pear abounds in Australia; the Canada and Russian thistles are common in many parts of this country, and the wild cherry is widely distributed. Unwittingly, automobile tourists are doing much to help spread various kinds of plants from wilderness areas to towns and cities.

WEIGHT OF AUTO OPENS GATE

Equipped with springs and specially constructed platforms, a double road gate devised by a Texas inventor, opens and closes without the aid of an operator. The weight of the automobile, which is driven upon the platforms, depresses them, actuating the mechanism which raises the leaves of the gate, and when the car has passed through, coil springs automatically return them to position, leaving the platforms in place for opening the gate from either side.



Auto Approaching Gate and, Below, Leaves of Gate Tipping Back under Weight of Car

Japanese Boys Snaring Dragon Flies on Lime-Tipped Poles; When Captured, the Insects Are Tied and Flown from the Sticks

SNARING DRAGON FLIES ON POLE FAVORITE JAPANESE SPORT

One of the most popular amusements among Japanese boys is the sport of catching dragon flies on long poles smeared with lime. When the insects are captured, they are tied with fine string and flown from the sticks. The dragon fly is known to almost every part of the world except the polar regions, more than 2,200 species being classified. A peculiarity of some kinds is that they choose a favorite twig on which to roost and always return to it even after long excursions after food.

SEA WAVES ACT AS "WIRELESS" TO GUIDE WHALES

Washing of the sea waves is the "radio beacon" that warns whales, porpoises and many kinds of ocean fish to keep away from the shores and under the surface in stormy weather, according to Dr. Austin H. Clark of the national museum. As the waves break, their high-pitched, hissing sounds are easily located, Dr. Clark declares, and because the noise continues, it causes the sensitive sea creatures to keep away from it.

Serving as a Strong Bridge over Deep Ravine, These Logs Are Doomed to Be Cut Up for Lumber When the Standing Timber Is Depleted

RAILWAY BRIDGE BUILT OF LOGS IS HUNDRED FEET HIGH

Spanning a deep ravine in an Oregon lumbering district, a bridge built of logs supports heavy trains passing to and from the sawmill, but is to be torn down and the pieces converted into lumber when available timber is cut from the area. The bridge is composed of 375 logs, from thirty to 110 feet long, and is 400 feet from bank to bank. Timbermen estimate that it represents about 500,000 feet of fir and 250,000 feet of hemlock.

WOOL DERIVED FROM WOOD

Prepared from cellulose, or wood fiber, artificial wool now being manufactured largely as a by-product from the synthetic-silk industry, is said to have the soft, warm feel of the natural article besides a lustrous quality, which improves the appearance of cloth with which it is used as a mixture. Officials of the department of commerce are of the opinion that the price of this substance will be between fifty cents and $1 per pound as compared to $2 a pound for natural wool, and one authority predicts that, in five years, the "wood wool" will be as common in our textiles as synthetic silk, which is now being produced at the rate of about 4,000,000 pounds a month in this country alone.

Hollowed and Polished Coconut Shell Is Back for Ukulele

COCONUT SHELL AS "UKE" BACK REPLACES WOOD

Hollowed and polished coconuts are being used in Hawaii as sounding boards for ukuleles. The shell is tough and vibrant and by cutting a wide opening on one side, a sufficiently large sound chamber is formed to amplify the tones from the strings. The modified instrument is called a "cocolele." The handle is made from koa wood.

¶According to scientists, there is no insect that has a fatal bite.

STEEL CYLINDERS FOR DAMS AID IRRIGATION

Large steel cylinders that can be raised and lowered by electric power are being installed in an irrigation district in Mexico where the streams are subject to sudden rises. The first of these was erected on a large plantation near Torreon. It consists of two cylinders, each sixty feet long and eight feet in diameter. They are operated independently on heavy racks by power equipment placed on a masonry pier in the center of the stream. When in place, they form a water-tight reservoir, but can be quickly raised to reduce the store in times of flood. Another dam near by has cylinders ninety feet long and twelve feet in diameter and was built at a cost of $250,000.

OUTDOOR ICE BATH IN JANUARY IN NATION'S HOTTEST TOWN

Guests of a bachelor hotel in a California town below the sea level, where the temperature rises to extreme heights even in January, are refreshed with ice baths outdoors at a small charge. Tubs are conveniently located near the dormitory quarters, and the ice man delivers supplies directly to consumers. Government weather bureau records show that this town is the hottest spot in the United States during part of the winter season.

Showing How Furnace-Pipe Units Resist Strong Pull, and Close View of Joints

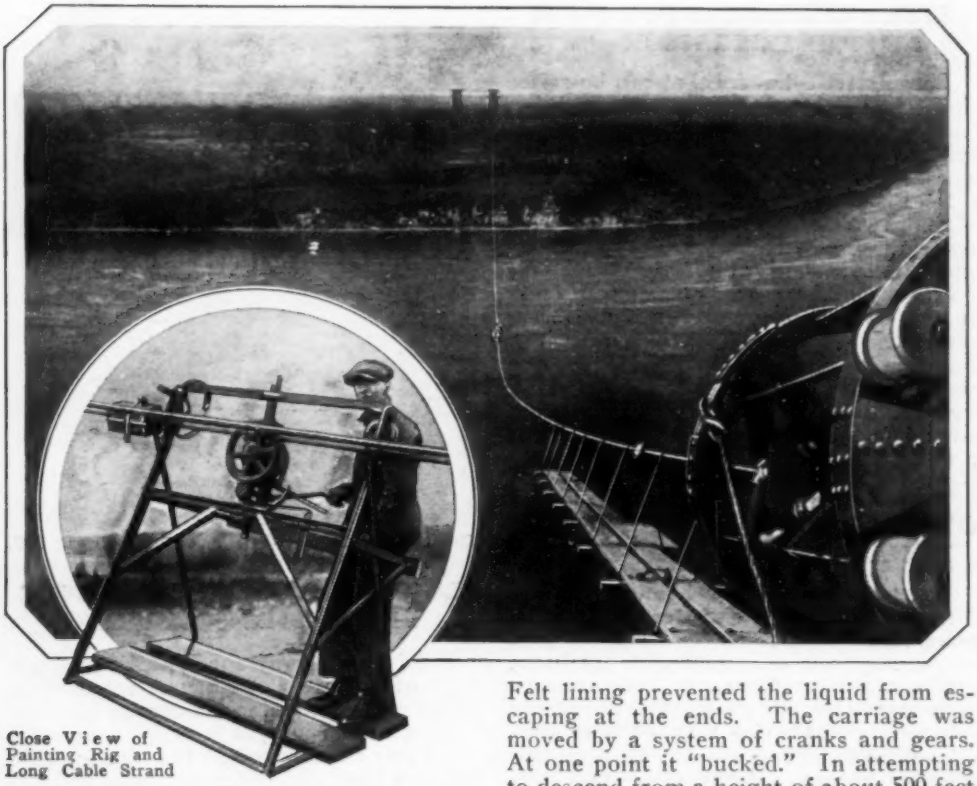
LOCK-JOINTED FURNACE PIPE ELIMINATES SOLDERING

Held together by special lock joints, a type of furnace pipe now on the market, requires no soldering and can be installed with greater speed, it is said. A smooth, rigid line results, and as the pipe is made with an inner and outer wall, greater heating efficiency is reported from it because of the dead-air space between the walls.

Bathing Hour in the Nation's "Hottest Town"; the Ice Man Delivers Cooling Chunks to Patrons Enjoying Outdoor Tubs

FLOWERS AS CLOCK

Knowledge of the actions of various kinds of flowers and plants enables the observer to tell the time of day, as blossoms unfold at nearly the same time during the proper seasons. Their hours of "awakening" will vary in different parts of the country. In New Zealand, for instance, naturalists have discovered that most wild flowers open about six o'clock in the morning. Various kinds follow at more or less definite intervals. Chickweed, for instance, opens at noon, while the garden marigold goes to sleep at three o'clock in the afternoon. Water lilies retire at four o'clock.



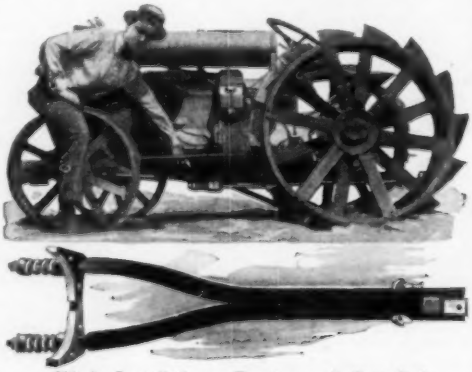
Close View of Painting Rig and Long Cable Strand

PAINTERS RISK LIVES ON CABLE TO PRESERVE POWER LINE

Cranking their way back and forth over the lengths of high-tension cables stretched across an arm of Puget sound, near Tacoma, Wash., painters on an improvised carriage had narrow escapes from death in coating the wire with a preservative to protect it against the elements. Always far above the water, sometimes 600 feet and never less than 245, they were exposed to the brisk winds from the ocean which caused their frail platform and the cable to sway. There were six lengths in all, and each was over 6,000 feet long. It took about four hours to make one crossing when everything worked smoothly. The paint was applied from a box compartment fitted with brushes which came in contact with the cable as it passed through. Felt lining prevented the liquid from escaping at the ends. The carriage was moved by a system of cranks and gears. At one point it "bucked." In attempting to descend from a height of about 500 feet on a guy rope, one of the men fell and was severely injured. He was saved from death by becoming entangled in the ropes 300 feet down.

UNDERSLUNG TRACTOR HITCH TO PREVENT CAPSIZING

Like bronchos, tractors sometimes rear up when too great a haul is attempted with them. To prevent this, a Texas inventor has devised an underslung hitch attachment which is said to center the pull midway between the four wheels and, by exerting at the same time a downward pull on the front of the tractor, helps to keep all four wheels on the ground and aids in steering. It is also said to increase the traction, and as the hitch is equipped with a spring, it acts also as a shock absorber.



Hitch Installed on Tractor and Detached

ONLY ONE-FOURTH OF CANADA SEEN BY WHITE MAN

Seventy-five per cent of Canada has not yet been seen by white men, according to R. H. Knight of Ottawa, president of the association of dominion land surveyors. He pointed out that travel is confined to the known routes and few persons ever visit the uninhabited regions that lie beyond. Only a small portion of the country has been mapped, Mr. Knight declared. From surveys made last year, it was discovered that the province of Ontario has about 1,500 square miles more territory than was previously estimated. During an exploratory trip in the northwest section of Canada, never before visited by white men, a series of lakes, 200 miles long, were discovered. It was also found that parts of the province of Quebec had sunk.

WOOD PAVING SET WITH RUBBER TO PREVENT SKIDDING

Surfaced like an automobile tire with projecting insets of firm rubber, a section of wood-block paving in England has been constructed to prevent vehicles from skidding. The special roadway lies parallel to one smoothly paved so that comparative tests can be made.

Knobs on the Pavement Instead of on Tires as an Experiment against Skidding

¶A locomotive recently built in the east contains 203 tons of steel.

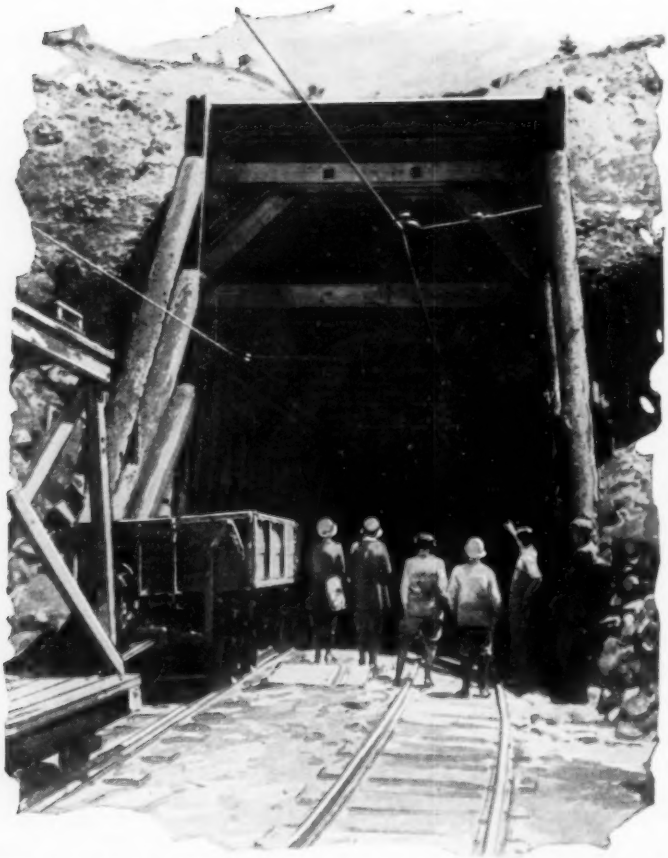
Playing a Musical Selection with Mixing Bowls for Radio Audience; Tones Resembled Chimes

MUSIC FROM MIXING BOWLS PROVIDES RADIO NOVELTY

Crockery mixing bowls of different sizes were used in playing musical selections from a radio station recently. Clear bell-like notes were produced but without the overtones that generally attend ordinary bells or chimes, it is said. Enough bowls were selected to give the notes of two complete scales and small hammers were used to strike them.

TREAT FOOD WITH ELECTRICITY TO IMPROVE HEALTH

By exposing certain kinds of foodstuffs to ultraviolet rays, the Scottish board of health is reported to have discovered a way for restoring vitamines destroyed in cooking. It was found that some kinds of food that tended to cause rickets were made entirely safe by this treatment. Milk, exposed to the rays, became richer, it was said, while a substance known as cholesterol, inherent in many foods, was made beneficially active by this application of electricity. For some time, ordinary electric light has been used for ripening oranges and other fruits. It is said to produce a better color than sunlight. Ultraviolet-ray treatments with quartz lamps are reported to be efficient in many cases as substitutes for sunlight.



Where Trains Soon Will Be Thundering under the Rockies; Entrance to the Great Moffat Tunnel Which Pierces the Continental Divide

LONG TUNNEL UNDER ROCKIES TO AVOID SNOW BLOCKADES

Opening of the six-mile Moffat tunnel under the continental divide in Colorado, scheduled for 1927, will permit more regular train service during the winter months especially, it is predicted, as delays due to snow blockades through that district will be avoided. Construction was started from the east and west sides, the eastern portal having an elevation of about 9,000 feet and the western 113 feet lower. To secure ventilation, suction fans are to be installed in the tunnel, and to eliminate as much smoke as possible, locomotives will bank their fires before they are to pass through.

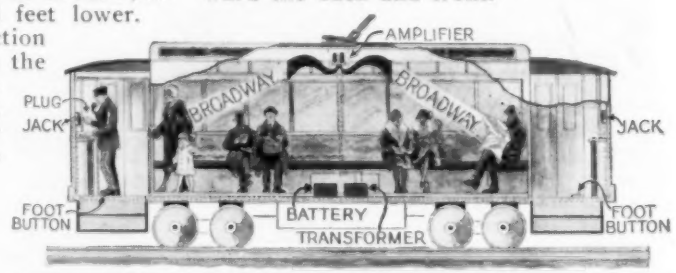
¶The earth is likely to be struck by a comet only once in 20,000,000 years, scientists declare.

PLANES FEED BIRDS DURING WINTER

Airmen went to the aid of the birds last winter in the snowy Alleghanies, dropping ear corn and other food from their planes. One aviator made half a dozen flights in one day, throwing out more than 150 pounds of feed, which was supplied by the Pennsylvania state game commission. An advantage of the scheme was that it reached the birds near their native haunts. While many species are to be found near the cities and in parks where they enjoy food supplied to them, others do not frequent settled districts and suffer severely when there is a scarcity of feed.

AMPLIFIER PHONE ON TROLLEY CAR CALLS STREETS

For the convenience of passengers and to permit wider use of the so-called "one-man" street cars, an electric amplifying apparatus for the motorman's voice is intended to enable occupants of the car to hear street names with little difficulty. The system used is said to be one that causes no distortion of the voice. The motorman wears a breastplate transmitter which is plugged into a jack at the end of the car. By pushing a foot switch, the amplifier is put in use and the sounds issue from a loud speaker that is mounted in the roof in the middle of the car and has two horns directed toward the back and front.



Sketch of Street-Announcer Apparatus as Installed for Use in Car; Motorman Speaks into Mouthpiece Strapped to His Chest

Robbing the Sea of its Terrors

Driven Ashore in the December Gale, the Crew of the "Comtesse de Flandres" Was Rescued by English Coast Guards Who Fired a Rocket Line for the Breeches Buoy from the Cliffs on Land

INVENTIONS of the twentieth century, not in use until this decade, have saved from death this winter scores of men in the most bitter gales in the memory of the present generation of seamen on the Atlantic.

Early the morning of January 24, a radio operator brought to Capt. George Fried of the United States liner "President Roosevelt" an SOS from the British freighter "Antinoe." The "Antinoe" was helpless in mid-Atlantic and being smashed and pounded by mountainous seas. Fried's ship was nearest.

The position given in the message indicated the "Antinoe" was 100 miles away. After the captain had changed his course he sent word to the "Roosevelt's" radio operator to check the position of the "Antinoe" with the radio compass, a device not installed on American ships until three years ago.

The operator carefully manipulated his compass and then rushed word to the "Roosevelt's" bridge that the "Antinoe" had given its position many points of the compass from the actual position. It proved later that their skipper's figures had been wrong by 100 miles. He had little chance to be accurate with snow and hail making astronomical observations impossible.

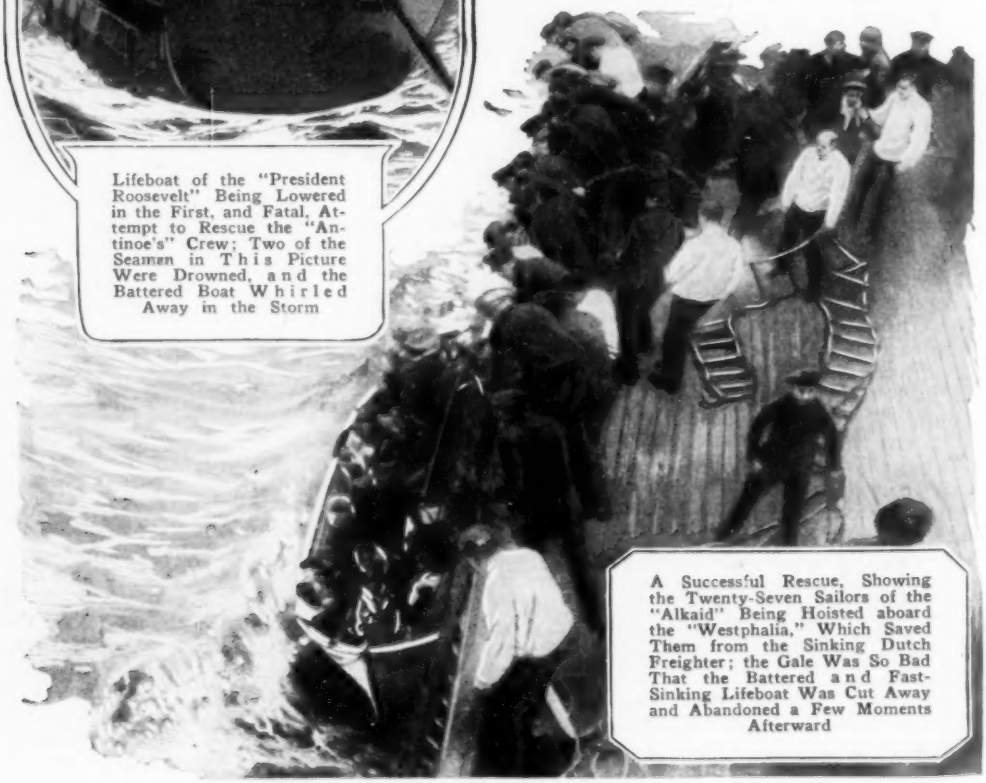
Only a few years ago the "Roosevelt" would have received the SOS but probably never would have found the "Antinoe." The men of the latter would have died as their ship plunged down while the "Roosevelt" was searching through hundreds of square miles of terrible seas.

The base of the radio compass is a large dial, marked with the points of the compass, and having an indicator placed over it which is attached to a loop aerial overhead. The aerial is on a pivot and can be turned in any direction by the operator.

When the radio operator of the "Roosevelt" was seeking the position of the "Antinoe" he turned the aerial until the dot-dash buzzing the aerial was receiving from the "Antinoe" was loudest. He noted the compass direction of the loop aerial and that was the bearing of the "Antinoe" from the "Roosevelt." His record was accurate. His success had depended entirely on his sense of hearing, which seems untrustworthy to the layman. But the use

Crew of United States Coast Guards, Above, Practicing Life-Saving Drill by Capsizing Their Boat in the Sea; the Picked Men of the Rescue Crews Must Be Familiar with the Behavior of a Boat in a Storm and Know How to Right It if It Upsets and Topples Them into the Sea; These Non-Sinkable Boats, Buoyed by Air Compartments in the Ends, Are Specially Designed with Hand Ropes Underneath So That They Offer a Hold for the Crew Even When Bottom Up and Can Be Righted Again

Lifeboat of the "President Roosevelt" Being Lowered in the First, and Fatal, Attempt to Rescue the "Antinoe's" Crew; Two of the Seamen in This Picture Were Drowned, and the Battered Boat Whirled Away in the Storm



A Successful Rescue, Showing the Twenty-Seven Sailors of the "Alkaid" Being Hoisted aboard the "Westphalia," Which Saved Them from the Sinking Dutch Freighter; the Gale Was So Bad That the Battered and Fast-Sinking Lifeboat Was Cut Away and Abandoned a Few Moments Afterward

of the compass this winter has proved its accuracy is almost mathematical. It is so certain in results that it may do away with lighthouses, radio beacons taking their place.

In Captain Fried's report to the United States lines he told of locating the "Antinoe" with the radio compass and continued:

"We arrived alongside her at noon with the wind west at sixty miles, accompanied by violent snow squalls and high rough seas, in which we were rolling thirty-five degrees.

"I took position a quarter mile to windward and poured oil overboard with excellent effect. Her captain claims this saved the 'Antinoe' from sinking.

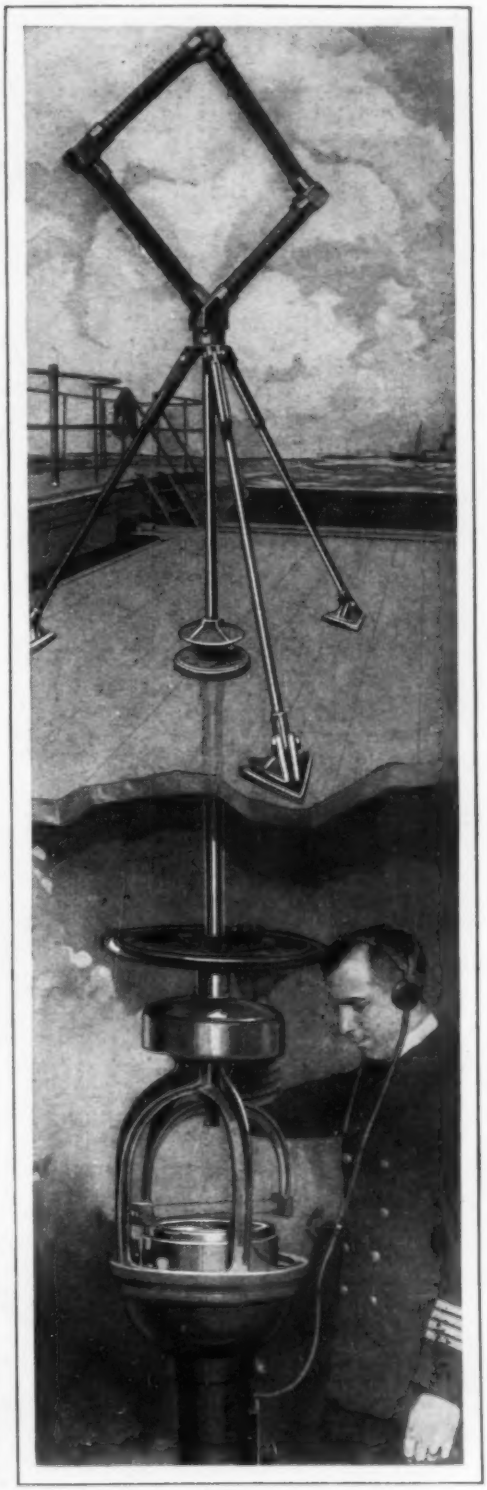
"I lost sight of her at 9:00 p.m. Her radio and dynamo were out of commission and there were severe snow squalls. Searched and picked up the 'Antinoe' again 3:40 p.m. on the twenty-fifth with engine and fireroom flooded, No. 3 hatch broken and boat listing heavily to starboard."

The officers of the "Roosevelt" did not believe the "Antinoe" could live through the night. Its starboard lifeboats had been swept away, the port lifeboats were stove in and useless, the steering gear was disabled, the navigating bridge wrecked by the fury of the seas, and the crew had only a flickering oil lamp for signaling.

Capt. Fried ordered away a lifeboat with chief officer Miller in charge. It was slung overside and lowered away. It was a Lundin boat, one of the strange-looking shallow tubs that have been adopted recently by several of the largest passenger liners. As it struck the water, its tackle was loosed and the men put their backs to sweeping the oars. They had taken a few desperate strokes, when a violent squall broke and the boat was whirled back to the "Roosevelt." As life lines were cast when it came alongside, a giant wave caught the boat and jerked it up perpendicularly to the water. Miller and his crew were pitched into the sea. High above them a dozen life lines were thrown, sea ladders were dropped and cargo nets were let go. All but two managed to reach the ship's side and were pulled to the deck.

"We made every effort," Capt. Fried reported, "to pick these men up, but were handicapped by darkness and continued snow and hail. Used powerful searchlights. Weather increasing.

"The twenty-sixth, continued on station distributing oil on weather side. 'Antinoe' showing one lamp. Her distress signals



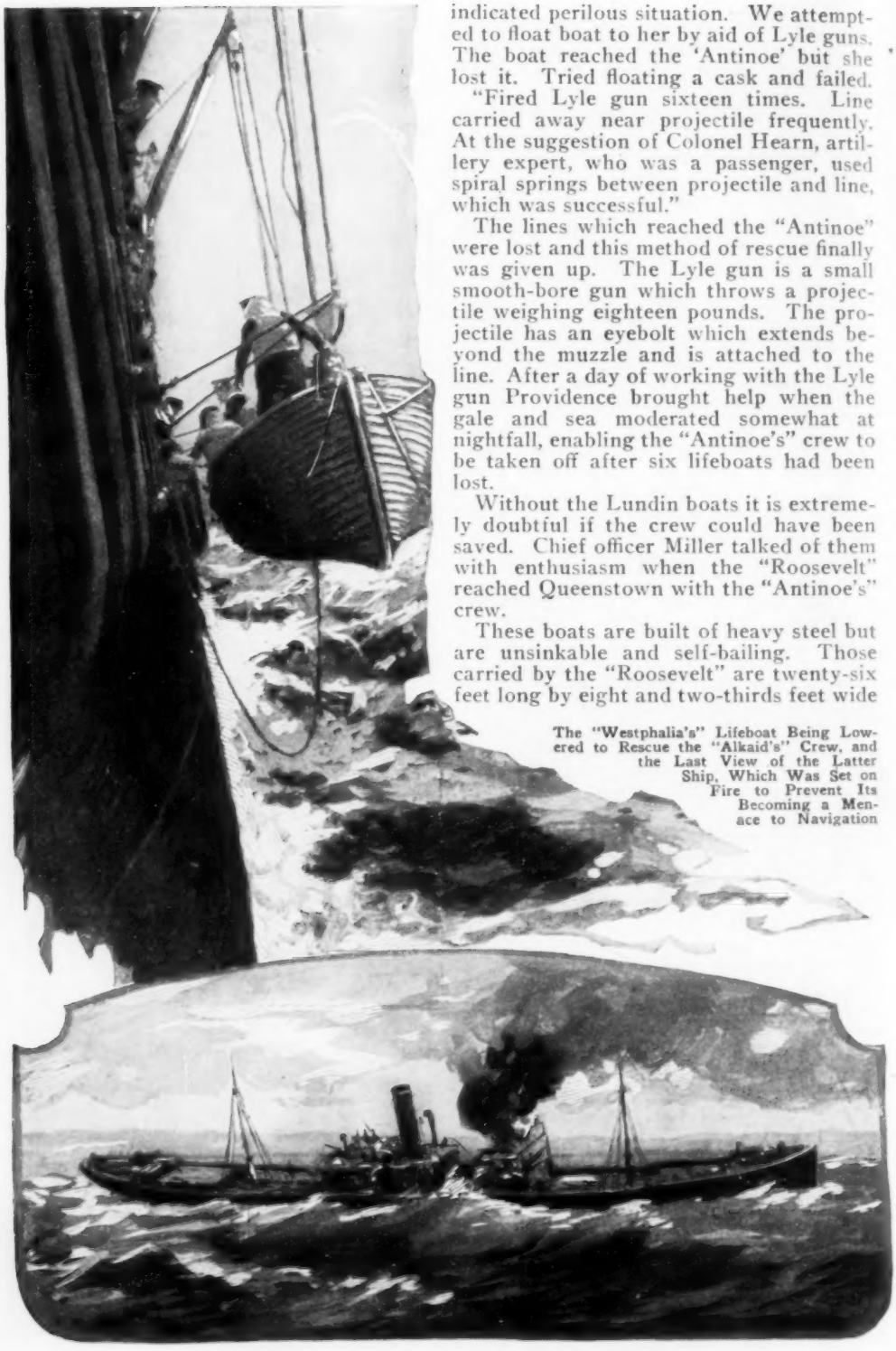
indicated perilous situation. We attempted to float boat to her by aid of Lyle guns. The boat reached the 'Antinoe' but she lost it. Tried floating a cask and failed.

"Fired Lyle gun sixteen times. Line carried away near projectile frequently. At the suggestion of Colonel Hearn, artillery expert, who was a passenger, used spiral springs between projectile and line, which was successful."

The lines which reached the "Antinoe" were lost and this method of rescue finally was given up. The Lyle gun is a small smooth-bore gun which throws a projectile weighing eighteen pounds. The projectile has an eyebolt which extends beyond the muzzle and is attached to the line. After a day of working with the Lyle gun Providence brought help when the gale and sea moderated somewhat at nightfall, enabling the "Antinoe's" crew to be taken off after six lifeboats had been lost.

Without the Lundin boats it is extremely doubtful if the crew could have been saved. Chief officer Miller talked of them with enthusiasm when the "Roosevelt" reached Queenstown with the "Antinoe's" crew.

These boats are built of heavy steel but are unsinkable and self-bailing. Those carried by the "Roosevelt" are twenty-six feet long by eight and two-thirds feet wide



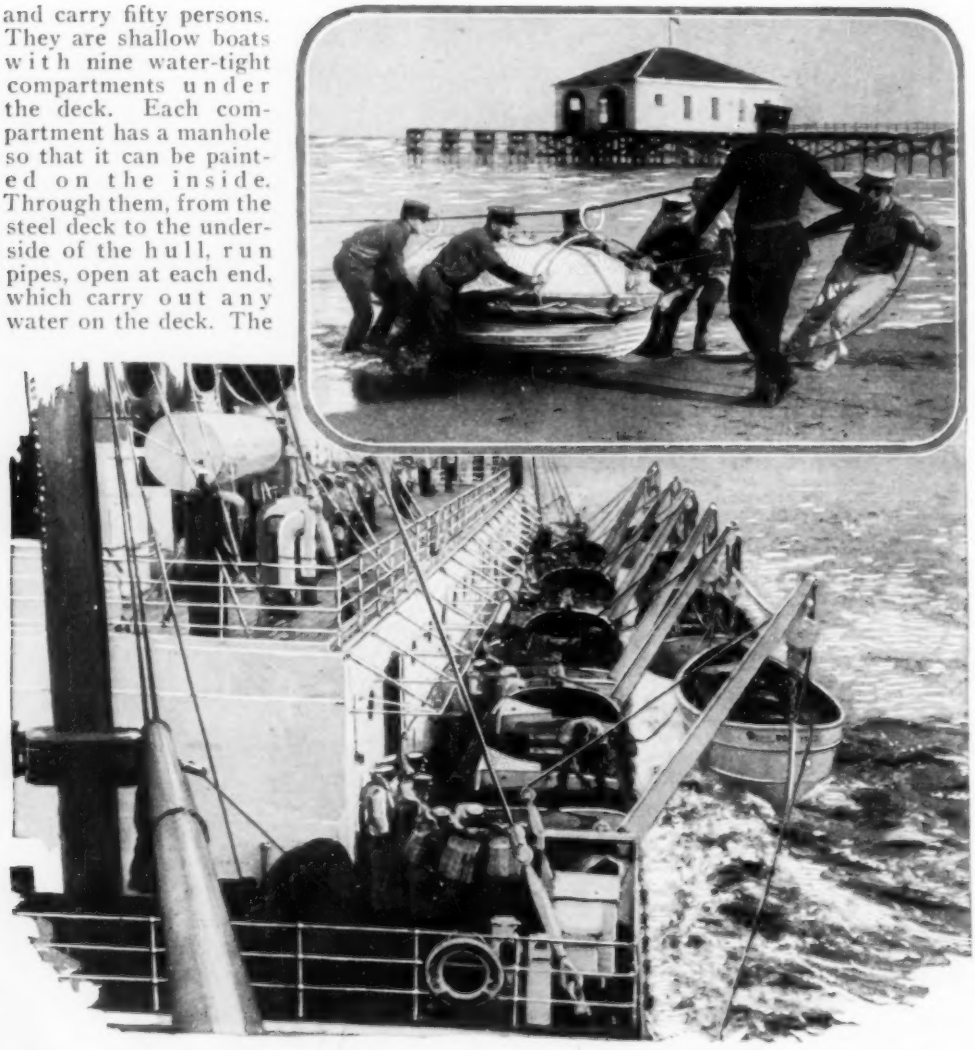
The "Westphalia's" Lifeboat Being Lowered to Rescue the "Alkaid's" Crew, and the Last View of the Latter Ship, Which Was Set on Fire to Prevent Its Becoming a Menace to Navigation

Coast Guardsmen on Long Island Launching Their Boat in a Heavy Surf as Part of the Regular Life-Saving Drills Which They Undergo to Keep Fit

Firing the Life Gun, Which Carries the Light Line from the Reel Out to and over a Sinking Ship, Followed by the Breeches Buoy

Hauling the First Man Ashore in the Breeches Buoy, One of the Most Efficient Rescue Methods in Use

and carry fifty persons. They are shallow boats with nine water-tight compartments under the deck. Each compartment has a manhole so that it can be painted on the inside. Through them, from the steel deck to the underside of the hull, run pipes, open at each end, which carry out any water on the deck. The



The Life Car, Top, Successor to the Breeches Buoy, Will Carry Ten People through the Waves in Comfort; Below, Lifeboat Drill on the "President Roosevelt," Showing the Safety-Type Boats

buoyancy of the boats is entirely due to the air-tight compartments, and the boats cannot be sunk unless these compartments are smashed. They cost $1,800 each.

Another valuable aid to the seaman in rescue work is the rocket, which has been in use for years. In principle it is like the small boy's rocket for the Fourth of July, but the simple device has aided rescuers to find ships in scores of instances.

All of the liners carry powerful searchlights, required to be always ready for use. The ships have bottle-shaped flares attached by lines to lifebelts on the rail, to be thrown overboard at night whenever a man is swept overboard. Before a flare is thrown, a pin running through it is pulled out.

As sea water gushes through the opening, it touches calcium chloride, forming acetylene gas and calcium phosphate, which ignites when coming in contact with water. The fire from the calcium phosphate sets the acetylene gas burning and makes a light of 250 candlepower. The flares in ordinary use will burn for three quarters of an hour.

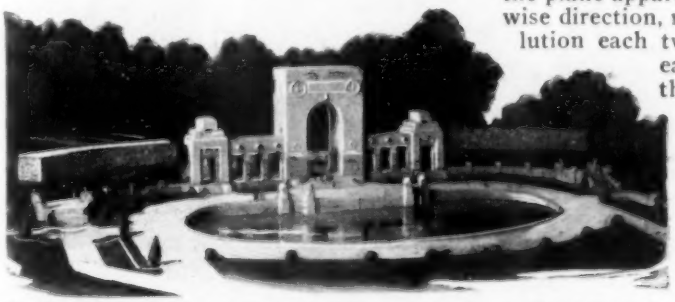
One of the crews saved by the radio compass was that of the Dutch freighter "Alkaid," sunk in the Atlantic. The men were brought into New York by the "Westphalia," February 7.

HUGE DAM TO WATER DESERT FOR RAISING COTTON

Opening of the great Sennar dam, on the Blue Nile in the Sudan, is expected to make some 300,000 acres of previously barren land suitable for the production of cotton. A crop of 400,000,000 pounds a year is anticipated when irrigation and cultivation are fully developed over the area. The dam is considered one of the great engineering feats of the world. Erected at a cost of more than $50,000,000, it is two miles long, required the excavation of 17,000,000 cubic yards of earth and the erection of 15,000,000 cubic yards of masonry. It holds back waters that ordinarily rushed to the sea and were largely wasted during the season of heavy rains. Four years were spent in building the dam and the work gave employment to thousands of natives who labored side by side with modern excavating implements. In mid-channel it is ninety feet thick and 130 feet deep. It has 206 sluices and spillways and the irrigation canal that is part of the project is sixty-six miles long.

MEMORIAL TO WAR FLYERS ERECTED NEAR PARIS

In memory of the famous Lafayette escadrille, a stone arch with facades to be inscribed with the dead and living members of the unit, is under construction in a park at St. Cloud, near Paris. The French government has set aside sixty acres for the monument, which is being built as a result of an endowment, provided by a New York and Paris lawyer, at a cost of about $125,000. The main arch will be over seventy feet high and will stand in an open glade in the midst of a forest.



Model of Memorial Built to Honor Members of the Lafayette Escadrille, One of the Famous Flying Units during the World War

Examining Pendulum in 100-Foot Shaft

HUNDRED-FOOT PENDULUM SHOWS EARTH ROTATES

Students at the university of Iowa have a graphic illustration of the rotation of the earth in a pendulum suspended from the top of a 100-foot shaft with its weight, a round ball weighing 100 pounds, adjusted over a graduated chart. Started swinging back and forth in a certain plane, the pendulum continues to oscillate in this plane, but due to the rotation of the earth, the plane apparently is turning in a clockwise direction, making one complete revolution each twenty-four hours like the earth, whereas it actually is the chart that turns with the earth. This instrument is an adaptation of the pendulum devised by Jean Foucalt, and demonstrated in Paris in 1851. To assure accuracy in starting, it was drawn aside and tied by a silk thread which was then severed by burning it off.

FLEXIBLE "GLASS" FOR AUTOS TO INCREASE SAFETY

Service in many fields is anticipated from a synthetic glass, the result of several years of experimenting by two Austrian scientists. The product is made of organic materials, is said to be hard, perfectly transparent and colorless and yet is so flexible that sheets and rods of it can be bent to a sharp curve or can be dropped upon the floor without damage. Even if it is broken, there is practically no likelihood of injuring the hands, for it does not splinter or leave jagged edges. This feature, especially, commends it for use in automobiles for windshields and windows, but it is expected to make serviceable insulating material, can be used in the textile trades, for transparent fuel tanks, dishes and glasses, and, possibly, for telescope lenses. Like quartz, it permits the ultraviolet rays to pass and thus opens up possibilities of greater adaptation of this treatment. It can be turned, drilled, cut, filed and polished, or etched with acids, and its specific gravity is only about one-half that of glass. The product is said to have been formed from formaldehyde and urea. At one stage in its preparation, it assumes a liquid form and can be poured like thick sirup. A ball made of the glass bounded to a height of more than twenty feet when hurled to a stone floor, and was not damaged.

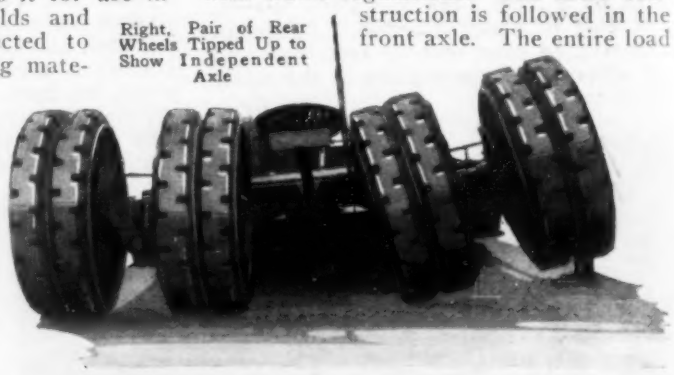
At One Stage in the Manufacturing Process, the "Glass" Can Be Poured like Thick Sirup

DAMAGE TO TREES BY INSECTS HUNDRED MILLION YEARLY

Damage done by the some 200,000 known kinds of insect pests that attack trees is estimated at approximately $100,000,000 a year, according to a bulletin of the American Tree association. Some authorities say that the loss from this cause is greater than that from forest fires. In a single section in Oregon, enough trees to build 8,000 homes costing about $10,000 each were killed by boring insects. Certain pests prey upon one another, thus protecting the trees, but the greatest natural allies of the forests are the birds, and in many parts of the country measures have been taken for their preservation.

SIX-WHEELED AUTO TRAILER CARRIES HEAVY LOADS

For transporting steam shovels, road rollers and other heavy construction equipment, a six-wheeled auto trailer has a capacity of twenty-five tons, yet is so designed that the legal limit of weight upon any one tire is not exceeded. This is made possible by the installation of two short axles in the rear. They move independently of each other and can be completely revolved in a vertical plane. This distributes the load between the four rear wheels and provides the necessary bearing on road surface at all times, to comply with traffic regulations. The same construction is followed in the front axle. The entire load is thus carried at three points, two in the rear and one in front, further relieving the trailer of undue strain.



Right, Pair of Rear Wheels Tipped Up to Show Independent Axle

Catching the Circus Menagerie

The "Ship of the Desert" Going Aboard a Ship of the Sea at a North African Port on Its Way to a Foreign Zoo; Elephants Also Are Handled in These Derrick Slings

Giraffes, Rhinos, Elephants and the Blood-Sweating Behemoth, a Ton or So of Hippopotamus, Come High These Days

By JOHN T. BENSON

THERE are two questions that interest all who visit our animal farm at Nassau, N. H., where all the wild beasts imported from Hagenbeck's for the American circuses and zoos are acclimated and handled after arriving from Germany, where they have been trained.

The first is why we don't import more giraffes and rhinos, which, next to the elephant, are the favorites of the big African animal class.

The second question is whether the high cost of living has affected the price of wild animals in the same proportion as it has other commodities.

Answering the second question first, it has; but after I tell you the story of how animals are caught, transported and trained, I think you will agree that they are worth all they cost.

As for the falling off in giraffe and rhino imports, the reason lies in the growing scarcity of the first and the savage disposition of the second. Not that the rhinoceroses seen in the circus or zoo over here are dangerous, for they were caught as babies, weighing only a half ton or so, and grew up in captivity, accustomed to being fed and cared for by men.

But when the animal collector in Africa goes out after a baby rhino and disturbs the peace and happiness of a two-adult-and-one-infant rhinoceros family, it is something else again. The adult in the wild has about the shortest temper of any animal known. It will charge anything or anybody on the slightest provocation. Take a ton and a half or two tons of rhino, armed in front with a single long bayonet horn, let it lower its head and start after you with the speed of a flivver on a good road, and it is time for the animal collector to keep cool and his nerves steady. It isn't pleasant to fancy that bayonet horn sticking through one, or that 3,000 or 4,000 pounds of mad rhino stand-

Left, Gorilla, One of the Only Two in Captivity, Arriving in New York; Above, the Chimpanzee, Most Humanlike of the Monkeys, in Its Winter Underwear; Below Is a Rare Ring-Tailed Lemur

ing over you tramping you into the earth. It is almost impossible to capture a baby rhino without a few men being hurt, and not infrequently some lose their lives.

Besides the difficulty of capturing a calf, the rhinos are all privately controlled by the rulers of each district, and it is necessary to get a special permit and pay a stiff fee for the privilege of trying to catch one —and if you don't catch it, you don't get your fee back. The armorplate rhino of India, for which the Roosevelt brothers recently have been hunting, is even harder to get—if the native maharajah can be persuaded to issue a permit.

Like the rhinos, the giraffes are protected by law and can only be hunted under permit. When the hunt starts, we

© John T. Benson

The Big-Game Hunter of Hagenbeck's in Africa, with a Party of Native Bearers Carrying in a Young Live Rhino, Trapped and Partially Tamed after Weeks of Hard Work

can't follow the movie-expedition method and round up a herd and chase them along before an auto until they are run out of wind. Any animal which has been run down and captured never lives long in captivity. Ask any race-horse man and he will tell you that when a horse has been ridden or driven beyond its limit it breaks either its wind or its heart. And so it is with all hoofed animals.

After our collector is on location and he and his horses and men have rested, it is easy to locate a band of giraffes, but to separate a yearling from its mother and the rest of the herd, and then capture it without exhausting or injuring it, is quite another matter. Then we have to get it back to the nearest of our African farms, which may be 200 miles or more away; get it contented and used to its surroundings; coax it to eat and drink, and finally pack it in a shipping box which must be upholstered like a parlor-car chair.

The nearest port to the farm is eighty miles away, and the big box must be hauled over the roughest kind of road, and upon arrival at the dock, it stands for a day or two with curious crowds constantly peeping in and annoying the youngster, with switch engines puffing and whistling all around, and a very bedlam of noises from the other animals which have been gathered to make up the cargo of the modern ark. The young giraffe hears the roaring of lions and leopards, the howling of jackals, the snarling hyenas, and through all this noise, our giraffe has to stand in its box half frightened to death, while we endeavor to secure a good location on the ship where it will be quiet and comfortable and have plenty of fresh air until it is unloaded at Hamburg, to get its land legs and rest at the European farm. Then it must be repacked and make another long sea trip to America, a fourteen-day journey, be unloaded and acclimated again, and finally delivered safely to its new owners.

Elephants, the most wonderful of all animals, have gone up in price along with

the others. I say the most wonderful, because I believe a good elephant is the most tractable of all wild animals. But the question arises, how you know a good elephant. Well, that requires years of experience, and it is partly for that experience that one pays when he buys an elephant. An expert can easily pick a good animal from a bad one, and let me tell you that a bad one is mighty poor property.

There are two reasons for the rise in prices of good elephants. One is that they are in very great demand and the other is that the supply is not so good as it formerly was. Our collectors have to go farther into the jungles and spend much more time rounding up a herd, and selecting and separating the best of them. Labor is higher everywhere, and all these things go to make the price greater.

When the Zoo Ostrich Gets a Sore Throat It Uses Up Several Rolls of Bandages, for, Like the Giraffe, the Ostrich Sore Throat Is No Mere Local Infection; Below, the African Game Hunter and His Wife Are Training a Couple of Lively Youngsters to Eat from a Pan

© John T. Benson

Even a Baby Giraffe, Caught on the Veldt, Is Difficult for Several Men to Handle

"Alice," the Baby Zebra of a Western Circus, in an Annual Consultation with the Doctor before the Show Goes into Winter Quarters

Baby Elephants Roaming the Decks, Monkeys Perched Everywhere, and Giraffes Sticking Out of Crates Lend Color and Interest to an Animal Ship

Three Specimens of Rare African Gazelle, Caught by the Big-Game Hunters, Being Trained to Drink from a Bottle in Preparation for Shipment to Civilization

Top Left, Center and Bottom Photos © John T. Benson

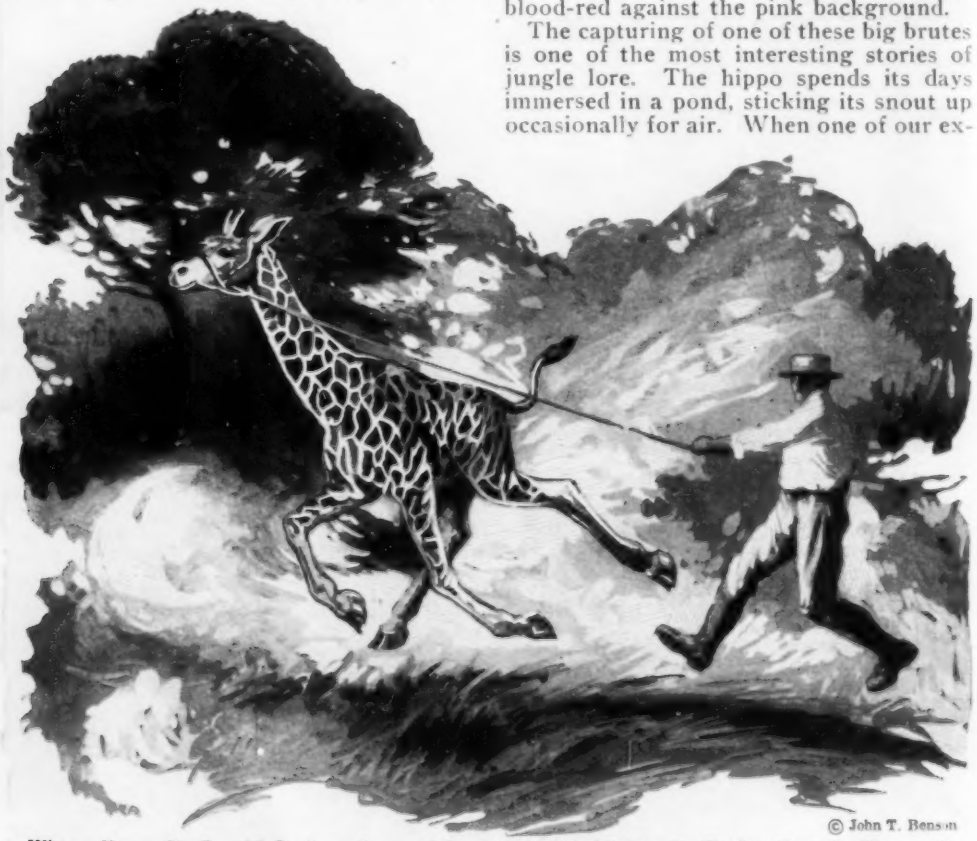
There was a time, not so many years ago, when the elephant drive always yielded a good harvest, say a hundred or so young ones, from which a number of perfect specimens could be selected. But now we are fortunate if we get eight or nine good ones from a hunt. After they have been rounded up in the Indian jungles, the procedure is much the same as with giraffes.

Some are selected for training and are divided into groups of various numbers, depending upon the circus act for which they are to be used. Others are taught to carry a howdah and allow children to ride on their backs. Elephants are always caught in the dry season, when their natural food is the poorest, and they have to tramp for miles to get a good meal. As a result, they are always in poor condition and have to be fed up for weeks before they can stand the first sea voyage to Hamburg. There is no young animal, except the giraffe, which is more subject to ills than an elephant. They require a lot of nursing, but once they become acclimated they will, with proper care, live to a great age.

Only a few years ago a shipment of thirty young elephants left Calcutta for Hamburg, and only twenty of them arrived, because of storms at sea. They all have been paid for in the jungles, in August, and it is March or April of the next year before the first one is ready for sale, while those being trained may not go on the market for a year or two; so you can see that dealing in animals is an expensive and precarious business.

There is another big animal which always draws a crowd to its tank in circus or zoo, and that is the hippopotamus. Since the days of Barnum, when the first hippo seen in this country was billed as the "blood-sweating behemoth of Holy Writ," they have been favorites. The hippo got its nickname from the fact that the pores of the skin open when they have been out of the water any length of time and the pink underskin shows through, while drops of water falling from it appear to come out of the hide and look blood-red against the pink background.

The capturing of one of these big brutes is one of the most interesting stories of jungle lore. The hippo spends its days immersed in a pond, sticking its snout up occasionally for air. When one of our ex-



© John T. Benson

When a Young Giraffe, with Its Long Legs and Queer Gait, Takes It into Its Head to Run, the Man on the Other End of the Rope Has His Hands Full and His Feet Busy

peditions locates a pond, the collectors wait until the monster has gone in for a bath, and then dig a ten-foot-deep pit in the runway it uses, since the hippo always follows the same trail. The bottom of the pit is covered with branches to break its fall, and the top roofed over with light sticks, leaves and dirt, to restore its natural appearance. When all is ready, the natives are sent around the pond to beat on tin pans and frighten the animal out of the water. It dashes madly up the runway and falls into the pit. Then a cage without a bottom—just four sides and a top—built of hardwoods and tough vines, is brought up and placed over the opening, and firmly lashed down to the near-by trees. As soon as the cage is secure, the men start shoveling the dirt back into the hole and the angry hippo tramps it down until it lifts itself right up into the cage.

The capture has only just begun when the animal is in the cage, for it must be left there to become more or less reconciled to conditions. This may take days or even weeks, and all the time the captive must be fed and watered and kept sprinkled with water. Finally, a bottom for the cage is made of saplings and slid under it, securely fastened, and the animal is ready to start its journey to the farm.

The cage floor is covered with leaves and moss to keep the hippo from becoming footsore or bruised, and also to hold the moisture, for it must be kept constantly wet. Long poles are placed through the cage, and gangs of natives carry the burden out of the jungle on their shoulders.

No zoological collection is complete without at least one of another species of African wild animal—the zebra. These pretty creatures roam in herds of considerable size on the African uplands, and in order to select the young ones suitable for export, it is necessary to build an enormous corral, round up the whole herd and water it for days, and sometimes for weeks, until they are quieted down and the selection can proceed.

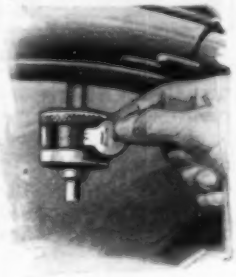
Tree Cottagers Have the Luxury of Abundant Cold Running Water Always at Hand and Radio for Entertainment

CABIN BUILT IN SLOPING TREE CONTAINS THREE ROOMS

Reached by steps upon a sloping tree trunk, a cabin built among the branches gives a group of young men in a Pennsylvania town a novel retreat for camping parties. The house contains three rooms and has the additional advantage of being protected from damp ground and insects that often mar the pleasure of living in such woodland cottages. A brook at the foot provides water for cooking purposes.

LOCK FOR SPARE AUTO TIRES SCREWS ON VALVE STEM

Spare tires are protected against theft by a lock that screws on the valve stem and fits tightly against the rim. A key is needed only in removing it, and there is a spring-steel dust guard to keep dirt from getting into the mechanism. If desired, the lock can be used on running tires.

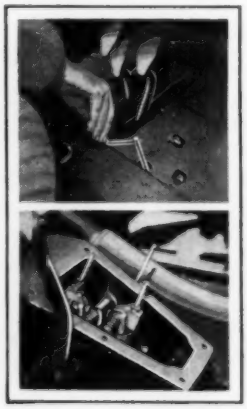


PUPILS TAUGHT BY RADIO IN WEEKLY LECTURES

Pupils in English School Listening to Talk on the Caribbean Sea, Broadcast from Station in Birmingham; Weekly Lectures of This Sort by Radio Supplement Regular Classroom Work

Radio has become a practical addition to the teaching facilities of an English school system as the pupils are given a lecture once a week from a distant broadcasting station on some topic associated with the work they have been studying. A loud speaker placed on the teacher's desk enables them all to hear distinctly, and they take notes while the lecture is in progress.

AUTO BRAKE-BAND ADJUSTER SAVES TIME AND WEAR



Brake and transmission bands on small automobiles can be accurately adjusted from the seat with an attachment operated while the car is moving, thus giving better results. It can be installed in half an hour with screwdriver and wrench, and consists of a cover plate to replace that already on the automobile's transmission and three adjuster stems which are substituted for the ordinary adjustment nuts. These project upward to the level of the floorboard, which is perforated to receive them. The other ends of the stems pass through slots in the transmission plate. With a special key, the stems are turned from the seat, to take up slack in the bands or loosen them, as needed. Much finer adjustments are possible with this device than with the nuts, it is claimed.

SUGAR AND RUBBER PRODUCED FROM SUNFLOWER AND BEAN

Oil of the soybean is the source of a rubber substitute scientists have prepared recently, and from a common kind of sunflower, known as the Jerusalem artichoke, chemists have extracted a sugar which is said to be fifty per cent cheaper than the cane or beet product, and sweeter, too. Two pounds of it will take the place of three pounds of ordinary sugars, it is reported. The plant from which it is derived grows wild in many waste places from Mexico to Labrador, and can be cultivated to give a yield of sixteen tons or more to the acre. Whether the rubber substitutes will be useful in the manufacture of automobile tires and parts has not yet been determined.

¶The Popular Mechanics' Bureau of Information offers its free service to all readers of our magazine. Names and addresses of manufacturers and dealers in articles described and any other details in our possession will be promptly furnished.

DOUBLE PRINTING FOR MOVIES TO SIMPLIFY PRODUCTION

Elaborate motion-picture sets will be unnecessary, and studios will need to be only a fraction of their present size, in the opinion of a Danish director, as the result of an improved double-printing process. The details of the method are being kept secret, but it is said the process consists mainly in having the actors perform their parts in front of black-velvet drops and supplying the scenery later from small, accurately constructed sets or reproductions of other pictures. It is now said to be possible to show characters, who really are in the studio, as though they were traveling in a boat up a river in an Amazon jungle. The expense of taking companies on location for the sake of special backgrounds will be spared, it is predicted. Use of this system already has been made to some extent, but much greater possibilities are anticipated from recent improvements.

RING THAT CARRIES PERFUME SHOOTS SCENTED SPRAY

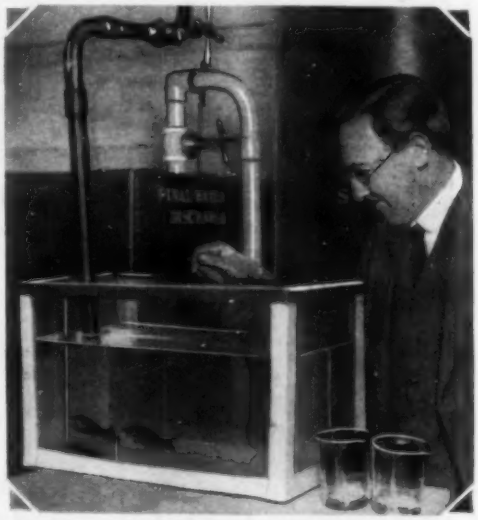
Concealed under a cameo setting in a novel ring now on the market is a tiny container filled with perfume. Pressure of the finger actuates a spring arrangement and a spray of the scent is sent forth. The design is said to have been inspired by the ancient poison ring, in which deadly potions were secreted for use against enemies or for suicide.

Ring Open to Show Tiny Space for Carrying Perfume Concealed beneath the Setting

¶In one year, a single oyster can produce as many as 1,000,000 new ones.

SEPARATOR FOR OIL AND WATER TO SAVE FISH AND BIRDS

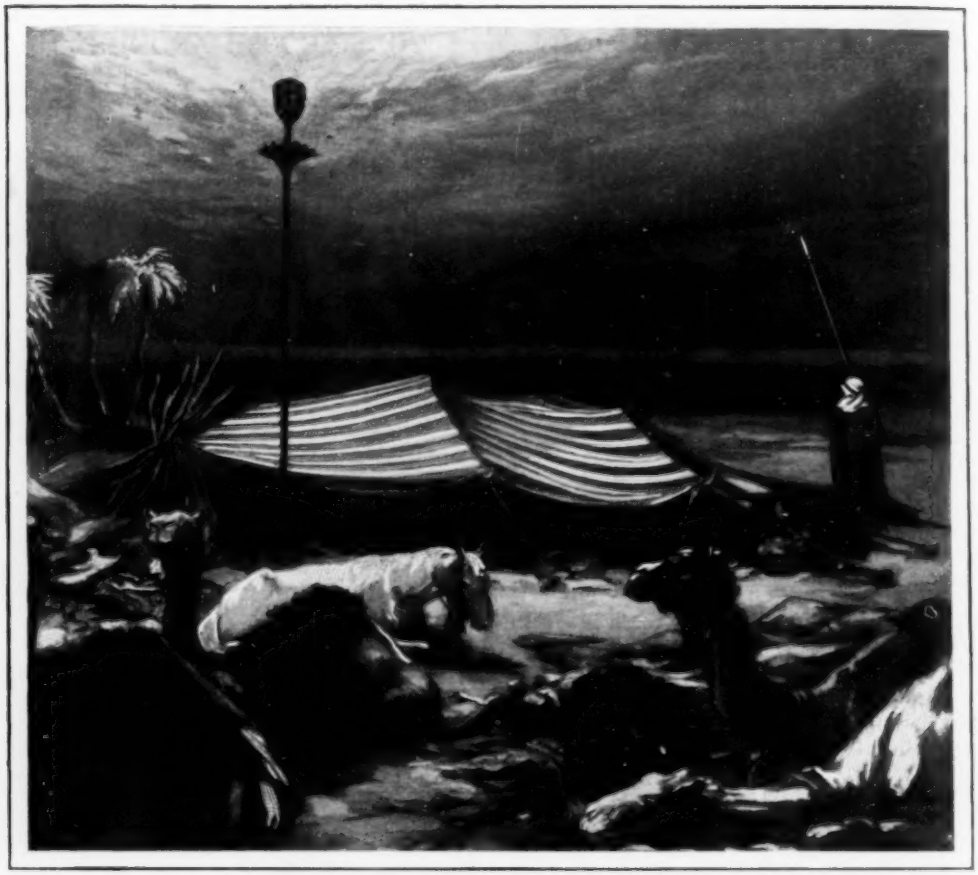
For removing the film of oil often spread upon the water by ships in harbors and rivers, an apparatus devised by an eastern inventor is expected to accomplish much toward protecting birds and fish from polluted waters. Sometimes a smothering coat of oil is driven inward from a considerable distance at sea, making it impossible for fish to obtain the necessary supply of oxygen and clotting the feathers of birds so that they are unable to fly.



Studying Tank of Goldfish After Oil in Water Has Been Removed by Special Process

TEN THOUSAND MILES OF ROADS PLANNED THIS YEAR FOR U. S.

During 1926, the federal bureau of public roads plans to spend approximately $95,000,000 in adding some 10,000 miles of government-aid highways to the present system. Much of this money will be spent in and near the country's national parks and through the mountains of the west, where public playgrounds are being developed and opened. The task of cutting highways through forests and ranges is not always simple. Care must be taken in blasting not to cause destruction of scenic mountainsides; timber stands must be protected, if possible, by building trails around them, or if that is not feasible, through them, with the least practical loss, and great vigilance must be exerted to prevent fires while the roads are being constructed.



Under the Glare of an Oil Flare, the Desert Pipe-Line Layers Slept While a Sentry, Armed with a Spear, Stood Watch to Warn of the Approach of Marauders

Steel Pipes Conquer Desert Wastes

Oil and Water Lines, Carried across the Sands on Camel Back, Introduce Modern Transportation to Persia and the Sudan

STRETCHING 150 miles across the burning waste of the Persian desert, a double line of steel pipes has just been completed after ten years' work to carry oil from Maidan-i-Naftun—the "Valley of Oil"—to the port of Abadan, on the Persian gulf. When the oil was turned into the pipes, one of the most traveled camel-caravan routes in the world was abandoned for this purpose.

For years all the oil from the interior valley has been brought to the coast on camel back, and ferried across the Tigris in native "gufas," small circular coracles built of wicker and plastered with pitch.

At almost the same time the Persian oil line was completed, another desert project was finished at Port Sudan, on the Red sea, which has finally acquired a waterworks by tapping the springs of the Khor Arbaat valley, in the Red sea hills. Until the present, the port's only fresh water came from distilled sea water, a limited and expensive supply. The operation cost so much that the occasional steamer that stopped there for water was forced to pay $2.50 a ton, an almost prohibitive price. Finally an engineer conceived the idea of piping a supply from the springs in the hills twenty miles behind the town, at an altitude of 350 feet above sea level. Six-inch pipe was carried in on camel back, the line laid and the springs deepened. The water flows by gravity down to the

In Boats of Wicker Work, Daubed with Pitch, Supplies, Men and Animals Were Ferried over the Tigris during the Building; Below Is the Pipe-Laying Gang, Guarded by Arab Soldiers Mounted on Matchless Desert Horses; Ten Years Were Required to Lay the Line to the "Valley of Oil"

Photos by Courtesy of British Petroleum

seaside town and is pumped into storage tanks, reducing the cost to slightly over fifty cents a ton. Here and there along the pipe-line route, open tanks were erected where caravans might water their camels. The spilled water around the tanks irrigated the surrounding desert land, and within a short time small bushes and grass sprang up, creating a series of oases.

The Persian oil-pipe line was a much more difficult feat. The age-old caravan route leaves civilization as it crosses the first sandhill outside the port of Abadan and enters a waste of sand, wild gorges and rocky defiles that have not changed since Bagdad and Damascus were in their prime. Fierce nomads infest the occasional water holes, and it was necessary to keep an armed guard on hand to protect each camp of pipe layers. Because of the intense heat of the desert only natives accustomed to the climate could do the manual labor under the broiling sun. Leaving the valley, the pipe line climbs mountain ranges and dips into deep gorges, necessitating several pumping stations along its 150 miles of length, and every piece of machinery, as well as all the building materials, had to be transported on camel and mule back. In the Valley of Oil a forest of derricks has been reared over the rich deposit, and a large boom town has sprung into existence, but the only connection with the coast continues to be the camel caravans and wicker boats on the Tigris, by which all supplies are brought in, and the homeward-bound workers taken out.

With plans under way for the development of the oil fields of Mosul, in the same region, the oil center of the old world is shifting to the regions around the Red sea and Persian gulf. Side by side with the ruins of towns that were at their best when the Old Testament was being

Mules and Camels Served to Transport the Steel Pipe and Pumping-Station Machinery across Mountain Passes and the Burning Desert Sands in This Land of No Railroads

lived, the steel of pipe lines, gaunt wooden derricks, and puffing engines of pumping stations are springing up.

The presence of oil beneath the desert sands is only another evidence that some of the most forlorn wastes on earth were once, long ago, garden spots where life flourished. Within the period of recorded history men have found little use for the bleak sand wastes, and they have lain almost unvisited by outsiders, save for an occasional archeologist, bent on exploration of the Biblical ruins, but now that oil is being produced in quantities, money and men to develop the country will be forthcoming in abundance. So far no refineries have been built near the wells. The output of the Persian field is pumped through the new pipe lines to Abadan, and on board of 10,000-ton oil tankers, for delivery to the refineries in South Wales. The fleets of huge tankers lie side by side in the harbor with Arab boats with their lateen sails and the gufas of the Tigris, an incongruous intrusion in an ancient setting.

Motor-Driven Bouy Towing Life Guard to Rescue, Saving Him the Effort of Swimming through Heavy Waves

LIFE BUOY DRIVEN BY MOTOR AIDS IN RESCUES

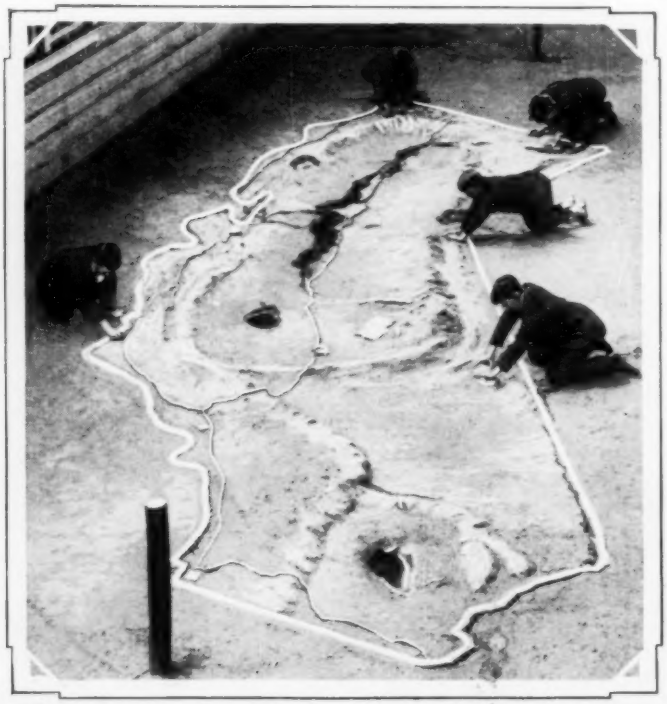
For towing a live-saver to the scene of the rescue and aiding his return, an electrically driven buoy controlled by a push button at the rear, has been tested at high tide and in heavy surf with satisfactory results, according to reports. The equipment is in reality a small submersible motorboat, capable of considerable speed, and as it conserves the rescuer's energy, he is fresh to meet emergencies that may arise when reaching the person in distress.

SELF-CLOSING WATER FAUCET REDUCES WASTE AND WORK

Easier to hold than the ordinary fixture of its kind, a self-closing faucet need be opened only part way to assure a steady stream of water and automatically shuts off the flow when released. It is easily installed and its simple construction is intended to make it last a long time without the need of repairing.

FIBER FROM TROPICAL LEAF WOVEN INTO BLANKETS

Said to resemble silk, a leaf fiber grown in Colombia, South America, is woven into blankets and clothing by the natives and also is used for fish lines. The leaves are from eight to fifteen feet long, and the fiber can be extracted by a simple process, according to reports.



Modeling Relief Map of California in Sand; Lakes, Mountains, Valleys, Railroad Lines and Other Features Are Plainly Indicated

MAKING RELIEF MAPS IN SAND AIDS STUDY OF GEOGRAPHY

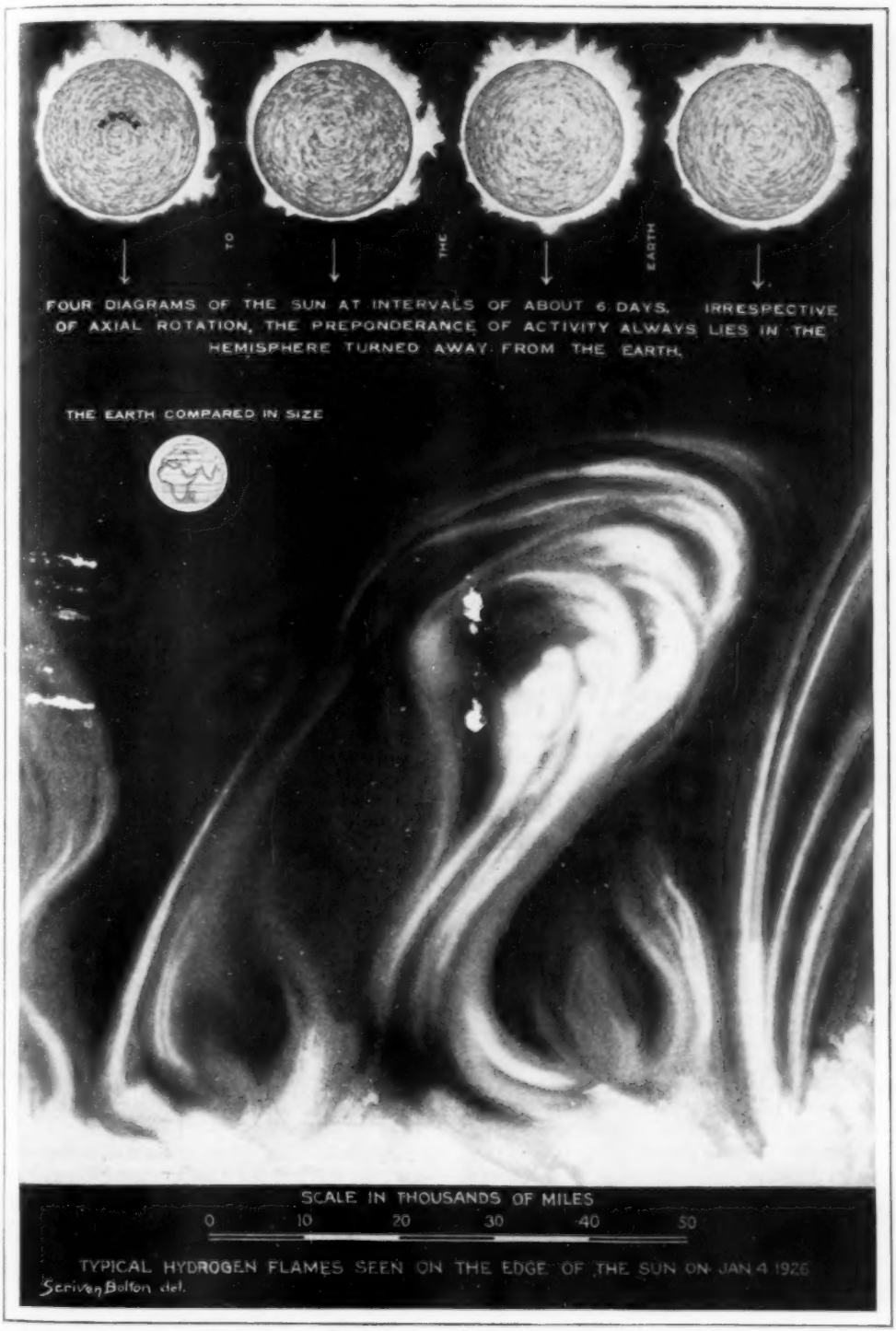
Students in a San Jose, Calif., school make use of a sandpile in the study of geography by molding material into model maps of their native state and other areas. Important topographical features are easily represented, and since the sand is so readily handled, "sketch" relief maps can be quickly formed to test the student's memory. Efforts are made to fashion the replicas in true proportions.

WHEN THE WAVES RUN WILD

Measurement of the pressure of the waves during heavy storms, as they crashed against lighthouses, have shown that the breakers sometime drive with a force of two tons and more to the square foot. At the Bell Rock and Skerryvore lighthouses, England, wave pressures of three tons a square foot have been recorded, and at Dunbar, a storm a few years ago piled water against the lighthouse in blows that registered three and three-fourths tons to the square foot. On one occasion during a gale on the Bay of Biscay, a block of stone, weighing thirty-six tons, was lifted by the waves and hurled over a breakwater. At Wick Bay, where a breakwater could not be constructed, a concrete block, weighing 1,000 tons, was laid down and secured with iron bars. The waves dislodged the huge block, easily snapping the bars as though they had been strings.

IS SUN BEGINNING TO DIE, ASTRONOMERS WONDER

In 1922, when the sun failed to deliver its annual contribution of heat to the world, astronomers prepared for a series of sunspot years. In that year the sun fell four per cent short of its average distribution of energy, but, more important still, it has not returned to normal in the three years that have elapsed since. The last few months have been marked by unusual weather disturbances due to sunspot activity, and the star gazers explain that the cause lies in the rare combination of a maximum of sunspots with abnormal tidal pulls, the two together affecting weather on the earth so seriously as to interfere with crop growing. Such a marked diminution in the heat cast out by the flaming gases of the sun is temporarily serious, but does not necessarily mean that the sun has begun to die. The life of a star is estimated at some 30,000 billion years, so the sun undoubtedly has a very long life before it. Observation of the sun's corona of flaming gases during recent eclipses has convinced astronomers that the other side of the sun, the hemisphere turned away from the earth, is always hotter, with bigger streamers of fire, than the face we see. As the sun revolves, the pennants of flame move across its face, the bigger ones always keeping opposite the earth. As cyclonic storms sweep across the sun's surface, these flaming columns of burning hydrogen and other gases tower 150,000 miles or more out into space.


TO
THE
EARTH
FOUR DIAGRAMS OF THE SUN AT INTERVALS OF ABOUT 6 DAYS. IRRESPECTIVE OF AXIAL ROTATION, THE PREPONDERANCE OF ACTIVITY ALWAYS LIES IN THE HEMISPHERE TURNED AWAY FROM THE EARTH.
THE EARTH COMPARED IN SIZE
SCALE IN THOUSANDS OF MILES
0 10 20 30 40 50
TYPICAL HYDROGEN FLAMES SEEN ON THE EDGE OF THE SUN ON JAN 4 1926
Scriven Bolton del.

Courtesy Illustrated London News

Hydrogen Flames on the Sun's Surface, Sweeping Along in an Anti-Cyclone, and, Above, Drawings of the Sun at Different Stages, Showing How the Greatest Flames Are Always Away from the Earth

Persons Crossing Footpath between Lakes Appear to Be Wading Due to Elevation of Upper Pond over Lower One

DAM BETWEEN LAKES CAUSES ILLUSION OF WADING

Two lakes, one set about three feet lower than the other and with stepping stones between them, cause a curious illusion in an English park. To persons standing at the upper end of the higher lake, those walking below the dam that separates the two, seem to be wading in the water above their knees. In reality, they are on the dry stones, the width of the path being so slight that the two lakes give the impression of being a continuous body of water.

SAFETY ON AMERICAN RAILWAYS DOUBLED IN TEN YEARS

Travel on American railroads is twice as safe as it was ten years ago, according to figures gathered by the American museum of safety. In 1914, one passenger was killed for every 6,620,000 locomotive-miles traveled and one was injured for every 116,000 miles, but in 1924, the lines operated 11,250,000 locomotive-miles to each passenger killed and 287,000 miles before one was hurt. Similar records have been made in regard to railroad employes, the reports show. In 1917, a worker employed by the railways was killed in an industrial accident for every 9,120,000 man-hours of labor, while in 1924, one was killed for every 15,550,000 man-hours. For every 28,000 man-hours of work, in 1917, one employe was injured, but in 1924, only one was hurt for every 48,000 man-hours. These improving records are attributed, in part, to the influence of the Harriman safety awards.

X-RAYS TEST GLASS AND FIND BUTTONS

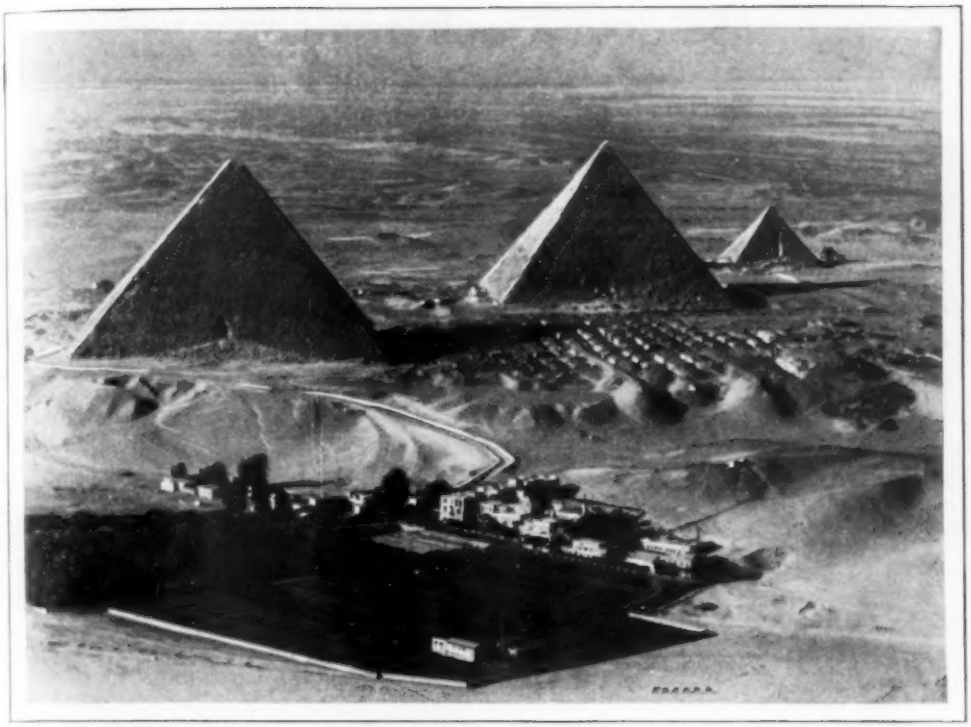
Aside from their use by the medical profession, X-rays have been adapted to service in various industrial activities. One of the most recent of these is in searching for buttons and other solid materials in piles of rags which are to be ground up for making paper. The rags are passed along endless bands moving over an X-ray tube. If buttons, hooks, eyes or other pieces that may damage the pulp machines are present, they can be seen distinctly on a screen just above the band. The rays are also employed in a large English laboratory for testing glass of which thermometers are made. Unsuitable glass can be detected in an instant by the X-rays, according to reports.

SPARE TIRE ON LUGGAGE RACK SERVES AS BUMPER

Baggage rack and spare-tire carrier are combined in an arrangement that has appeared in England, and is said to be particularly adapted to small cars. The wheel is securely locked in place and easily removed, and when the rack is in the "down" position, the spare projects sufficiently to form an efficient bumper. When it is mounted in a vertical position, the wheel is inconspicuous.

Placing Spare in Baggage Rack, and How It Acts as a Bumper When Carrier Is Down

¶ The Bible has been published in twenty-three dialects of English.



Airplane View of Great Pyramids at Gizeh, Showing Modern Hotel with Shaded Yards and Gardens in Foreground; a Smoothly Paved Road Links the Past and Present

ANCIENT AND MODERN EGYPT SHOWN SIDE BY SIDE

While ancient Egypt gave much thought to the care of the dead, the nation today is by no means neglecting the living, as is seen in the modern hotel built specially for tourists at the foot of the great pyramids near Gizeh. Within a short distance of these venerable monuments, travelers can enjoy most of the conveniences that an up-to-date city hotel provides, while shaded grounds and gardens are furnished for their pleasure. A view from an airplane presents this contrast at a glance, the old Egypt typified by the solemn stone tombs of its kings and the new represented by the hotel near by.

TRAFFIC CODE FOR AIRPLANES TO SAFEGUARD SKY TRAVEL

Similar in some respects to automobile-traffic regulations, a standard aeronautic safety code, announced recently, gives balloons the right of way over both dirigibles and airplanes, while dirigibles have precedence over planes. When aircraft meet, they shall pass to the right as in street traffic, and when one overtakes another, it shall turn to the right in going by. Approaching craft are said to be in dangerous proximity when 1,500 feet apart. In the rules for medical examinations of aviators, a test for "night blindness" is included, and a "good family history" with reference to nervous stability is another requirement.

SCREEN DOOR UP IN SECONDS WITH SPEEDY HINGE

Screen doors may be hung or removed in ten seconds with a spring hinge now being marketed. The pin connecting the parts attached to house and door is inserted by the tap of a hammer or removed by a slight upward thrust. Another feature is that the springs are covered and are not displaced when the holding pin is removed. The hinge can be used on either side of the door.

FIGUREHEADS FROM OLD SHIPS VALUED AS DECORATIONS

Among the most highly prized of the relics saved from old ships of Nelson's day

Measuring Figurehead of First Duke of Wellington, a Typical Decoration Such as Adorned Old Ships

and from other vessels, are the carefully carved oak figureheads which adorned the prows. A London shipbreaker has collected a number of these specimens, and after they are repaired and redecorated, they are in great demand as antiques. A giant figurehead of the first Duke of Wellington, shown in the accompanying illustration, is typical of the carvings which were lavished on the ships of olden days.

SEEK FOR RUBBER SUBSTITUTE IN KIDNEY BEANS

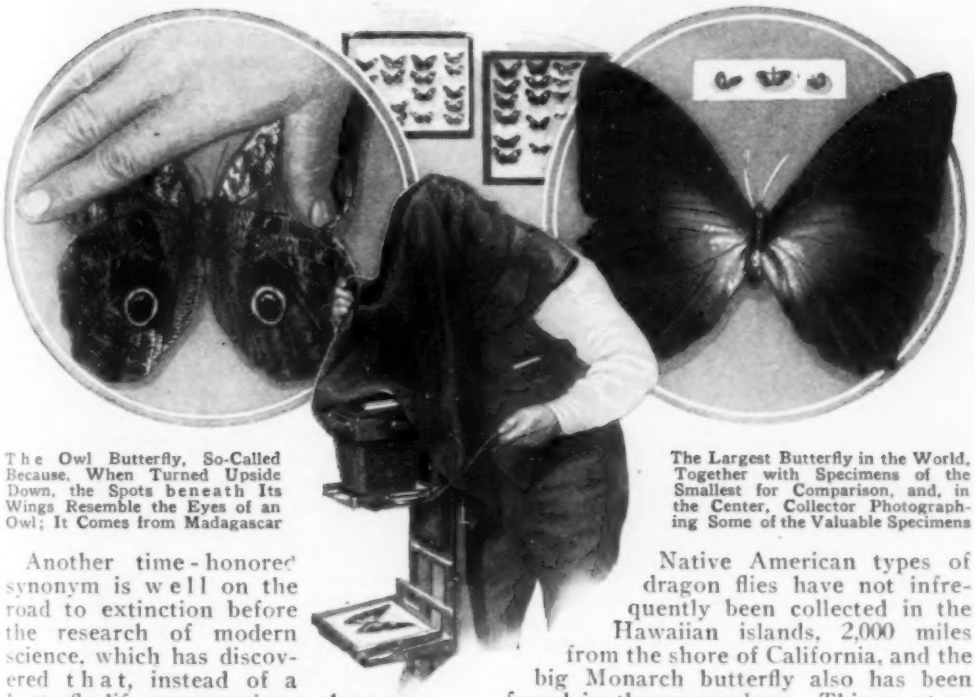
Chemists are reported to have found a way to make synthetic rubber from the soybean and now an English expert claims that the ordinary garden variety of kidney bean may be used for a similar purpose. The beans are partly dried after gathering, broken up and then treated with various chemical solutions until they are reduced to a substance that has the appearance of rubber and can be vulcanized in the same way as the true product, it is said. To further cheapen the substitute, experiments are being made to cross-fertilize the beans in order to make the plants more prolific as well as to produce larger seeds with a minimum of leaf and stem development.

REAR SEARCHLIGHT ON TRAIN ILLUMINATES SCENERY

Beauties of the scenery along the right of way of a western railroad are not lost when darkness falls, for a huge searchlight, installed on the rear of passenger trains, permits a clear view of woods, streams and even mountains at a considerable distance from the observation platform. The light is supplied with current direct from the railway system, which is electrified, and is focused to illuminate a wide area. It can be swung about with little difficulty. In emergencies, the light can be used with a red disk as a warning to trains behind.

Enjoying Scenery from Observation Platform after Darkness; Powerful Electric Searchlight, Supplied with Current from the Train System, Gives Passengers a Chance to See Wayside Beauties at Night

Seagoing Butterflies Amaze Scientists



The Owl Butterfly, So-Called Because, When Turned Upside Down, the Spots beneath Its Wings Resemble the Eyes of an Owl; It Comes from Madagascar

The Largest Butterfly in the World, Together with Specimens of the Smallest for Comparison, and, in the Center, Collector Photographing Some of the Valuable Specimens

Another time-honored synonym is well on the road to extinction before the research of modern science, which has discovered that, instead of a butterfly life representing a short and idle existence, it really is devoted to remarkably long-distance traveling. E. P. Felt, state entomologist of New York, and other scientists who have recently made a study of the movements and distribution of various butterfly types throughout the world, have reached several amazing conclusions. They found that throughout the East Indies, from Singapore to Thursday island, the large tropical moths which spend their days gathering nectar from the flowers are addicted to long night journeys. Ships anchored as much as twenty miles off shore are visited by swarms of the brilliantly colored insects, attracted from shore by the gleaming electric lights.

The flights frequently occur during dead calms, disposing of the belief that the butterflies might have been blown out to sea, as often happens with birds and various kinds of insects. Large butterflies and dragon flies are both listed among the ship visitors. The latter have been encountered 900 miles west of Australia, and 300 miles from the Cocos or Keeling isles, a barren waste on which they could not have existed. From their types it was considered probable that they had flown all the way from Sumatra.

Native American types of dragon flies have not infrequently been collected in the Hawaiian islands, 2,000 miles from the shore of California, and the big Monarch butterfly also has been found in the same place. This creature is perhaps the greatest of the insect travelers, for it annually migrates, in a series of varying stages, from Florida to the Arctic circle and back again. The Arctic offers a paradise for flower-feeding insects during its brief summer, for when the snow goes, myriads of brilliant flowers spring up in its place.

The Red Admiral, another famous traveling butterfly, is a world-wide cosmopolitan. Entomologists have encountered it in virtually every section of the globe.

Even such fragile flyers as the lace-winged flies and plume moths, about as substantially built as thistledown, regularly visit lighthouses twenty miles or more at sea. Many of them may drift along before favorable winds, but a surprising proportion of the journeys checked shows that either calms or unfavorable winds would eliminate this factor.

TROUT EGGS SHIPPED TO JAPAN

Japanese streams are to be stocked with brook trout from Canada if experiments now under way prove successful. A shipment of 50,000 eggs was sent from hatcheries at Vancouver at the request of the British ambassador at Tokyo.

Newspaper Rolled to Form Horn for Novel Stringed Instrument Played like a Cello

NEWSPAPER SERVES AS HORN ON STRINGED INSTRUMENT

Tones produced by a novel stringed instrument devised by an eastern musician are said to be amplified and improved simply by rolling a newspaper into the shape of a horn and inserting it in an opening near the base of the piece. The paper acts as a vibrating diaphragm, as in radio loud speakers of that material, and there are no metallic sounds as is sometimes the case when horns of metal are used. The instrument is essentially like a violin.

FIRE HOSE WRITHES LIKE SNAKE DURING STRENGTH TESTS

Fire alarms sound, engines, trucks and ladders speed to the scene of the flames, long lines of hose are laid with almost incredible swiftness and streams of water are soon shooting at tremendous pressure upon the blaze. This happens many times every day, and failures in equipment, particularly hose, are rare in up-to-date departments. This is partly due to the rigid system of strength tests to which the government subjects fire hose to meet the requirements of the bureau of standards. One of the instruments used for the trials is a hydraulic pump. A length of hose is attached, and by progressive steps, the pressure is raised from ten to 400 pounds to the square inch. The high point is maintained for ten minutes, after which careful measurements are taken to determine what effect the treatment has had on the hose. The pressure may then be increased to more than 500 pounds, causing the length to squirm and coil like a snake. Minute inspections are made for leaks and sweating. There is on record at the bureau, where thousands of feet of hose are tested every year, only one instance of a length of hose bursting under a pressure of 550 pounds to the square inch. Such failures are exceptions to the rule, for most manufacturers have learned the secrets of making a strong, durable product. One of the regulations of the bureau is that the hose shall be flexible and easily coiled. For instance, a fifty-foot length, two and one-half inches in diameter, must coil within a circle of a diameter not greater than twenty-eight inches. Proportionate limits are fixed for hose of different sizes and kinds. By chemi-

Testing Fire Hose at Bureau of Standards; Pressure Is Accurately Measured and Lengths Closely Examined for Signs of Strain

cal tests, the scientists determine whether or not sufficient rubber has been used in the lining, at least seventy-five per cent by volume being a requirement. The total sulphur content must not be more than eight per cent of the total weight of the rubber as compounded, and the material must be free from oil substitutes and reclaimed rubber. Tests are also made to determine the degree of adhesion between the backing and jacket; couplings are carefully examined as to their quality, threads and gaskets, and the bureau requires that each length averaging fifty feet must be provided with couplings made of an alloy of copper, tin, zinc and lead, each in properly prescribed proportions. In testing single-jacketed hose, one requirement is that it must not rise from the surface on which it rests to a greater distance than four inches under a water pressure of 400 pounds to the square inch.

RUBBER HEELS ON HORSESHOES PREVENT SLIPPING

To lighten the horse's task on slippery streets, shoes that have thick rubber heels, with suction cups affording a firm grip on the pavement, are said to have proved practical and humane. They are so adjusted that most of the animal's weight is carried on the heel, reducing the wear on the toe calks, and there is less danger of causing wounds to the horse's foot, it is declared. There are only two calks to change on each shoe, instead of four or more on other types, and when the shoe wears down too low to give a sharp support on ice, it is still suitable for several weeks' service as a summer shoe, the manufacturers assert.

¶According to a British naturalist, the thrush can sing for sixteen hours at a time.

WORLD OF MOSS AND PLANTS SHOWS FLORIST'S SKILL

One of the features of the grounds at the national military home at Leavenworth, Kans., is a model of the world in moss and live plants arranged over a framework of wooden slats and wire. One species of plant forms the hemispheres and another, of lighter shade, represents the oceans. The interior of the globe is filled with moss to afford a bed for the roots of the outside growths. Considerable skill was required to fashion the sphere accurately and substantially, and correct selection of plants was necessary to assure proper growth for keeping the right proportions of land and water areas.

World in Moss and Shrubs Must Be Kept Carefully Trimmed and Trained to Maintain Areas in Proportion

ONLY FEW FARMS HAVE RADIO CENSUS SURVEY SHOWS

According to a recent survey of twenty states by the census bureau, out of the 1,853,869 farms in those districts, only 109,992, or less than six per cent, are equipped with radio sets. Of the twenty listed, Illinois made the highest showing, reporting a total of 27,434 sets, while Kansas was second with 13,189 sets. In September, 1925, the department of agriculture reported that little more than eight per cent of all the nation's 6,372,263 farms were equipped with radio receivers, and the more recent tabulation indicates that there is still a wide market for wireless apparatus among farmers.

GAS DRILLS FOR POLICEMEN AID IN BANDIT WAR

Members of the San Francisco police department are given weekly drills in the use of gas and protective masks

Policeman Wearing Mask of the Type San Francisco Department Has Adopted for War on Bandits

to help them in this mode of attack against criminals. Army officers from the Presidio near by give the instruction, the policemen being taught how to adjust their masks quickly and securely and how to use tear-gas and other kinds of bombs.

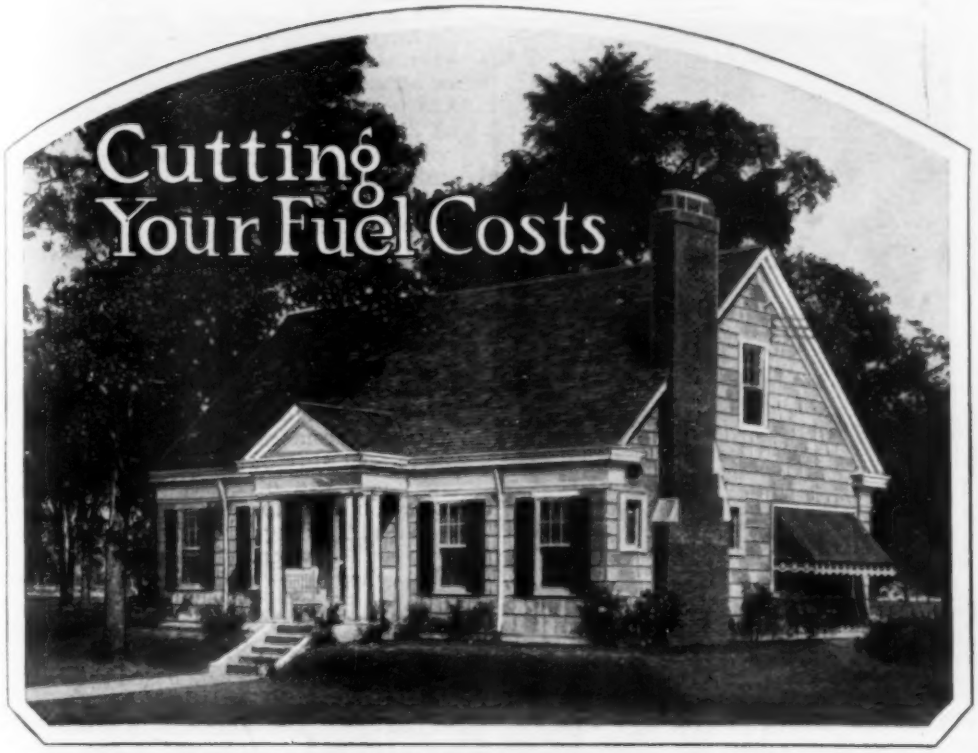
TASK OF MENDING OCEAN CABLE REQUIRES SKILL AND NERVE

When the transatlantic cable from Cape Cod to Brest, France, breaks, the repair ship "Edouard Jeramec," a marine oddity among vessels with huge tanks that hold 250 miles of cable below decks, is dispatched to the scene and the work of mending the break which has been located by delicate instruments, is begun. Sometimes the strands have parted in mid-ocean. Down go grappling hooks weighted so that they can be sunk to a depth of three miles if necessary. Buoys are posted to mark the ends of the cable when it is found, and powerful winches fore and aft are ready to raise or reel out the heavy wire. Severe winds and raging seas must be disregarded and even night does not stop the work, for the scene is illuminated by powerful lamps. Often, before the cable has been pulled to the deck, it breaks again and slides back to the mud and slime of the ocean floor. Last June, just as the crew of the "Jeramec" was finishing the last splice on the broken cable, off Cape Hatteras, a terrific storm broke, throwing the ship on her beam ends. The wireless aerial was sent spinning to leeward where it became tangled in the propellers and the vessel's topmasts were torn off. But the damage was mended by the eighty-five sailors aboard, and the ship returned to complete the task of fixing the cable.

BOOK CARNIVAL HELD IN RUSSIA TO STIMULATE EDUCATION

In the interest of better school facilities for the citizens, a book carnival held in Moscow, Russia, featured a parade in which lines of marchers, carrying placards and banners, endeavored to spread their message for more education. The affair, staged at a time when the streets were crowded, attracted wide attention.

How the Russians Support Better Education, a Book Parade at Moscow during Literary Carnival



Completely Insulated House of Seven Rooms in Which Gypsum Product Was Used in Walls and Roof, While Many Novel Ideas Were Worked Out in Construction of Interior

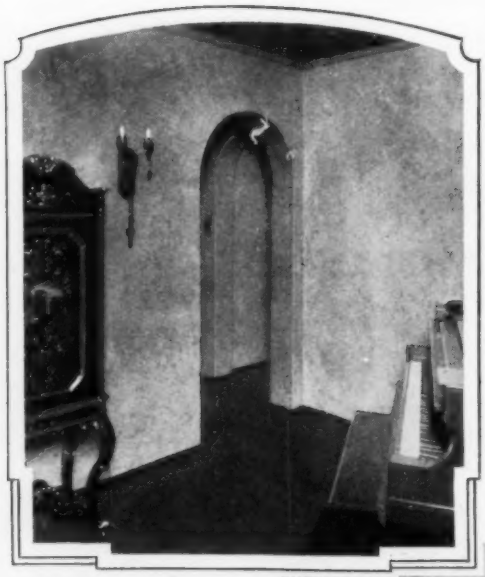
New Methods Quickly Pay, While Fuel Bill for Uninsulated Home in Twenty-Five Years Equals Cost of House

AN insulated house will more than pay the cost of the insulation through fuel saved in the first three years, according to a recent report of the United States bureau of industrial research. Heat, the report explains, leaks through lumber, brick and stone just as it does through glass, though not so fast, but with proper insulation, fully thirty, and probably fifty per cent, of the nation's fuel bill can be saved.

A seven-room house, heated by a tiny gas boiler designed for warming garages or heating hot water for apartments, has attracted thousands to a new subdivision at the edge of one of Chicago's forest preserves, just outside the city limits, during the past winter. Here, where temperatures are commonly several degrees lower than in the crowded city districts, unusual heating records have been made. The insulation used, a new gypsum compound, is the outstanding feature, but the interior of the house presents a number of interesting departures from the usual building mode. The insulation, fire, sound and heat-proof, is poured into the walls and roof like cement, and completely fills the space between the studding and rafters, making a solid wall from the shingles on the outside to the wall paint inside. The two-by-fours used for the frame construction actually measure three and five-eighths inches, so the gypsum has a corresponding thickness.

Maintaining, by means of automatic thermostatic controls, a constant temperature of seventy degrees from 4:00 a.m. to 10:00 p.m. and sixty degrees during the night, and heating with gas at seventy-five cents a thousand cubic feet, the fuel cost from October 1 to February 1 totaled $110, with an estimated cost for the entire winter of $160. The insulation proved so successful that snow remained on the roof for days, until melted by the sun, while heat leaking through the roofs had removed it from all the neighboring homes.

The insulating material, called insulex, comes in bags, like cement, and is mixed



Arched Openings with No Casing, Top; Right, Pouring the Insulating Material, and, Below, the Specially Built Doors and Hand-Wrought Hinges

with water. Owing to the presence of other chemicals with the gypsum, it expands in a few minutes after mixing to several times its original bulk. In this condition it is poured down inside the walls and allowed to set, hardening into a spongelike and porous mass, filled with millions of tiny air cells. The frame of the house was covered on the outside with plain matched sheathing, over which the shingles, dipped in pale-gray stain, were nailed. The inside walls, instead of being plastered, were covered with a gypsum wallboard, and after both sheathing and wallboarding were in place, the insulation was poured. The space between the roof rafters was treated in the same way, and in addition two inches of insulation was placed beneath the lower floor, in order that the floor might be warm while the basement, which extends under the entire house, would remain cool.

Gas engineers estimated that to heat an uninsulated house of the same size, twenty-nine by forty feet, with five rooms downstairs and two upstairs, would require a boiler with a rating of 1,150 feet, and a direct radiation capacity of 575 feet. Figuring on the insulation, however, they guaranteed that a small garage or hot-water heater, with a rating of only 425 feet and a direct radiation capacity of 213 feet, would keep the house at a constant temperature of seventy degrees when the weather outside reached twenty below zero, about the lowest sub-zero temperature ever experienced in Chicago suburbs. Recording thermometers were placed upstairs and down, with bulbs outside the house, in the living room, in one of the second-floor bedrooms and in the attic space under the roof. A recording chart was hooked to the heater, to show when the gas was turned off and on by the thermostat regulator, a thermometer was added to give the temperature of the water in the heating pipes, and other thermometers installed in the dining room at the floor and ceiling levels and midway between. The record charts made many interesting disclosures. In computing the heating required, the engineers based their calculations on a water temperature of 180 degrees in the pipes, since most hot-water heating plants work at from 180 to 200 degrees to maintain seventy-degree temperatures in the

View of the Living Room with Arch to the Tile-Floored Dining Room Beyond; Note the Rough-Painted Walls, Absence of Wooden Trim, and Sense of Space Because of the Broad Arch

rooms. Actually, the charts disclosed, it was only necessary to heat the water to 140 degrees on a day when the temperature outside was sixteen below zero, while with temperatures down to freezing, 110 degrees in the water pipes kept the house at seventy. In the twenty-four hours during which it was sixteen below zero outside, the recording chart on gas consumption showed that the gas was turned off for a total of seven and a half hours. On another winter day, when the outside thermometer chart showed temperatures fluctuating between thirty-five above zero and one degree above, the gas-consumption record showed no gas consumed for five hours during the day and six hours at night, or a total of eleven out of twenty-four hours when no fuel was needed to keep the temperature constant.

The thermometers at floor and ceiling in the dining room never recorded a greater variation than eight degrees, and the average was four degrees, as compared with differences of sixteen to eighteen degrees in uninsulated homes. Humidity records, taken at intervals, showed a very high percentage, never less than forty and frequently as high as forty-nine per cent, indicating that the even distribution of heat and the fairly low temperature needed in the radiators did not dry the air out as in the ordinary steam or hot-water heated house.

The cost of the insulation was $435, and approximately the same amount was saved at the start on the cost of the heating plant, since less than half the usual boiler and radiator capacity was required.

Some of the unusual methods of finishing the interior are as interesting as the results of insulation. Wallboard was used instead of plastering, a gypsum paint replaced wallpaper, interior trim was practically eliminated, and by using archways, most of the downstairs doors were dispensed with. Even the closet doors, with the exception of those in front of the linen and storage closets, were eliminated, and arched openings, with attractive curtains, took their place, giving a sense of greater space and connecting rooms.

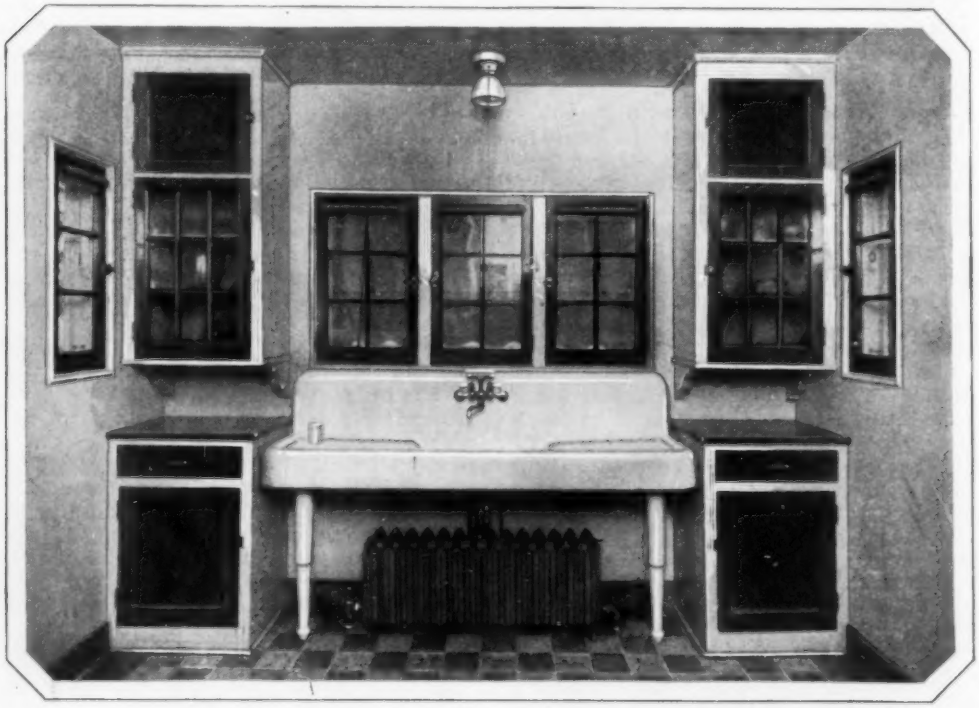
The saving on doors and interior woodwork, including the expense of painting and varnishing, was estimated at some $1,700. Instead of the usual baseboard, a very narrow molding was placed at the bottom of the walls. Window casing was

replaced by a half-inch half-round molding, such as is used on window screens to cover the edge of the wire, and the mold was then painted over with a special wall finish, kraftex, as was done with the picture mold just below the ceiling, giving both the appearance of being part of the wall, instead of being nailed on as an added accessory.

The arched openings were formed quite simply by cutting the wallboard to the shape of the arch, placing chicken netting across the top for reinforcing, a form below it, and pouring the insulating cement in from above. The usual cracks around the windows were avoided by cutting the wallboard to project over the window frame, and nailing it in place, while the insulating filling poured into the wall formed a solid bond with the frame.

The house cost $13,000, at the relatively high prices for labor and material in Chicago. The cost also included a number of expensive time and labor savers not found in the average small home. A fireplace and outside chimney costing more than $600 could have been built much more cheaply, or eliminated entirely. The built-in electric refrigerator cost $385. Rubber tiles, a half inch thick, on the kitchen floor cost $9 a yard. The dining room was floored with tiles, but here the cost was no more than a good grade of oak flooring and a good carpet would have been. Fifteen hundred dollars was spent for bathroom fittings, including white tile almost to the ceiling line. An expensive type of hot-water heater was installed, and likewise a garbage incinerator. The gray shingles on the walls and the green shingles on the roof were selected wide stock, all hand-dipped. The lighting fixtures downstairs were specially designed and made by hand by a worker in wrought iron. The doors, such as were used, were designed from a model seen in a new movie theater, and built to order. Instead of having panels, they are built of solid oak planks, two inches thick and six inches wide, running lengthwise of the door, and at the joint there are beveled grooves approximately three-eighths of an inch wide and nearly as deep. The hinges were designed and made to order of ornamental hand-wrought iron, extending nearly halfway across the doors. The price of $13,000 also included complete built-in kitchen-cabinet equipment.

It is because of its heating record, however, that the house attracted engineers



Photos Courtesy H. S. Ashenhurst

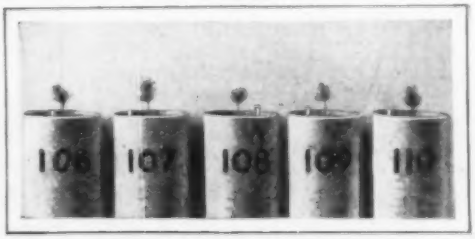
Part of the Built-In Kitchen Equipment, Which Includes Extensive Cabinets, Drawers and Other Receptacles; the Floor Is Made of Rubber Tiles, Half an Inch in Thickness

The Tile-Floored Dining Room Is Likewise a Livable Sun Parlor, Made So by the Small Space Taken by the Gate-Legged Dining Table, Which Seats Eight When Raised

and architects from many cities, as well as thousands of home owners—more than 10,000 of the latter passed through it in three weeks. The gas engineers estimated that it would have cost $350 to heat the house uninsulated, more than twice the expense this winter. The fuel saving made it possible to use gas, requiring no trouble, making no dirt, and leaving no ashes, at a price less than coal would have cost in the same house without insulation. Because of the absence of fuel bins and dirt, the big basement, with its cement floor waxed, has been used for community dances and other functions, the small boiler, and the water heater and garbage incinerator occupying only a limited space in one corner.

TREES ARE WATERED BY TUBE TO MEASURE THIRST

Some 700 young trees are being used in a series of experiments at the Rocky Mountain forest station on Mount Manitou, Colo., to study their rate of growth; how much water they require, and other features. They are being grown in iron cans with the soil surface covered with paraffin to prevent evaporation of the water which is poured in through a small glass tube. By weighing, the amount of loss through the leaves of the tree is determined. The observers have found that probably less than one per cent of the water is taken up into the permanent structure of the trees, the rest being "breathed out" in the form of vapor. Five specimens, shown in the illustration, each consumed about a gill of water during a season's growth at the end of two years. The tests will cover a period of four years. About forty plants of the different specimens will be saved for the final observations. The others are pulled up and photographed from time to time. A background of plotting paper permits quick calculations as to the amount the trees have grown.



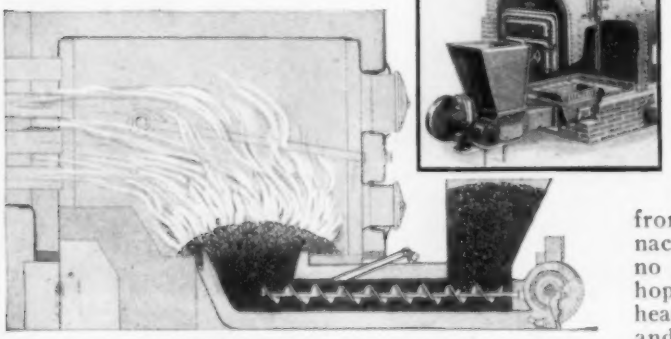
Young Trees Growing in Iron Cans at Experiment Station; Water Tubes Are Seen above Rims

¶From two day coaches combined, the first palace sleeping car was built in 1858.

Kite, Seed Containers in Forester's Left Hand, and Reel Attached to Fender

SOWING TREE SEEDS FROM KITE SHOWS HOW NATURE PLANTS

Nature's own method of sowing was adopted by foresters in Washington recently when they scattered the winged seeds of the Douglas fir from a kite flown to a height of about 175 feet. Squares of white canvas were spread on the ground at intervals to leeward, up to about 1,600 feet distance from the kite. By counting the seeds that fell upon the canvas, it was estimated that approximately 80,000 seeds were distributed to the acre. The velocity of the wind was measured for the experiments by an instrument carried on the automobile, which was also provided with a reel for controlling the kite. A day when a moderate breeze was blowing was chosen for the test. The seeds were carried in small receptacles so arranged as to allow the contents to fall at a fairly even rate.



Cross Section Showing Worm-Screw Feed, Hopper and Interior of Firebox, and Inset of Typical Installation with Small Furnace

HUMAN VOICE LIKE ORGAN PIPE WITH VIBRATING REED

One reason why great voices are rare is that few persons have the combination of physical characteristics necessary for the production of exceptional tones, according to a British doctor. The human instrument somewhat resembles an organ pipe. Instead of a vibrating reed, there are vocal cords, while the larynx and the bronchial system below it correspond to the pipes. The throat, mouth and nasal cavities form the resonators, and by alterations in their shape and size, certain parts of the fundamental tones produced in the larynx are emphasized. Slight differences in the structure of the various parts have a profound effect on the voice. Variations in the length of the vocal cords determine the pitch; the shorter they are, the higher are the tones. For this reason women's voices are higher than men's as their vocal cords have an average length of only about eleven and a half millimeters, while the average length in men is fifteen and a half. The range of the voice depends to a large extent upon the tension which can be exerted upon the cords. Except in celebrated singers, the range only in rare cases has exceeded two and one-half octaves, which, of course, lie in different parts of the musical scale for different voices.

STOKER FOR SMALL FURNACES SAVES COAL AND SMOKE

Adapted to heating plants no larger than those used in residences as well as larger units, an automatic coal stoker now on the market eliminates practically all smoke, reduces soot and saves fuel. It is operated by a small electric motor which turns a feeder shaft, supplying coal from a hopper into a retort within the firebox. A fan supplies air, aiding in the combustion of gases and the thorough burning of the coal. The stoker is regulated so that it automatically stops, and starts again when more fuel is needed. It may be installed at the front or at the side of the furnace and requires practically no attention save refilling the hopper. Parts exposed to the heat are cooled by the fan, and the coal feed can be adjusted to different rates.

The Start of a Balloon Tire; These African Women Are the Backbone of the Rubber Industry in That Continent, for They Do the Actual Work of Tapping Trees and Gathering the Sap

Rubber Farm to Cut Cost of Tires

World's Need for Lower Prices Brings Life to Liberia, Founded by American Ex-Slaves More Than Hundred Years Ago

THE world-wide search for more and cheaper rubber for automobile tires has ended the century-long nap of Liberia, the hermit republic on the west coast of Africa, where English is spoken as the official language and where towns are named for American cities. Liberia was founded in 1822 by an American who took a few freed slaves back to the African coast, and has been recognized as a republic since 1848, but it remained for the demand for cheap rubber to give it a place in the business world.

An American tire maker, seeking some escape from the high prices fixed by the British rubber monopoly, found ideal rubber land in the hermit republic and has leased and started development on a million acres, capable of growing 100,000,000 trees and, within the next decade, supplying nearly one-third of the world's rubber. Fifty thousand acres will be planted during the first half of 1926, and a similar number during the last half. The rest of the million acres will be planted as fast as the land can be cleared, roads built and workers gathered.

The task is aggravated because of the backward condition of the country. Since the republic first was founded and its capital, Monrovia, named for President Monroe, the country has been content to sleep. Part of the coast region, to a depth of fifty or sixty miles, has been partly cleared, particularly along navigable streams. There are, however, no roads, except for one of fifty miles out of Monrovia and another five miles long. There are no railways, telegraph, steamers on the rivers, nor any modern improvements. Before the rubber land can be planted, it will be necessary to build roads and railways, telegraph lines and telephone systems, and import tools and machinery.

The rubber development is expected eventually to produce much wealth, and therefore taxes, which in turn will provide money for the development of the rest of the country. One reason for Liberia's backward condition is the inability of the government to collect taxes from the natives, and this, in turn, is due to the lack of progress which has left the natives poor.

Liberia has always been closely related to American ways because most of the officials either were born in or are descended from negroes born in the United States. From time to time movements have been launched for the migration of large numbers of American negroes to the black republic, but each time they failed, largely because the prospect of living in

Top, Boiling a Small Lot of Sap beside the Tree; Planting the Seedlings, Center, and Below, Gathering the Sap

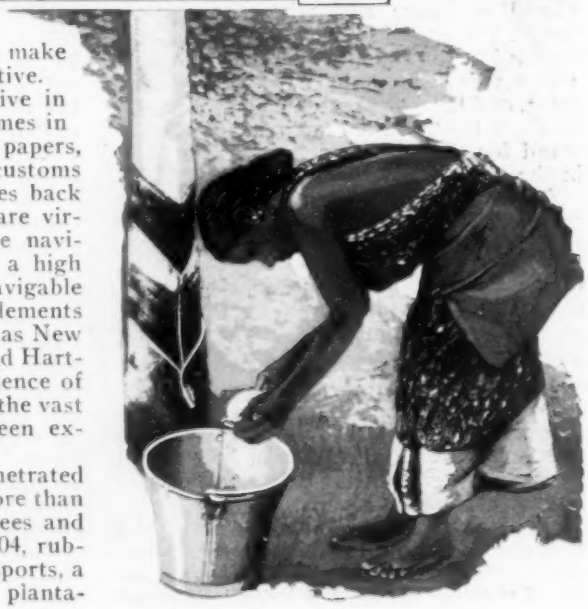
such an undeveloped country did not appeal. The new rubber industry, which will employ all native labor at the start, is expected, in time, to make residence in Liberia more attractive.

The better class in Monrovia live in houses modeled after southern homes in America, read American books and papers, speak English, adopt American customs and currency, but only a few miles back from the coast such innovations are virtually unknown, except along the navigable rivers, and these, owing to a high plateau in the interior, are not navigable very far. The few backwoods settlements rejoice in such incongruous names as New York, Philadelphia, Bunker Hill and Hartford, but outside of them the influence of Monrovia is little felt, and, in fact, the vast part of the country has never been explored or mapped.

The explorers who have penetrated parts of the jungles have found more than twenty varieties of wild rubber trees and vines growing there, and, since 1904, rubber has formed a portion of the exports, a British company having started a plantation which now has been acquired by the new American company as a nursery and experimental station.

The development of the million-acre lease is expected to take a number of years, but the first trees, planted this spring, will be ready to yield rubber within five or six years. Rubber trees are planted in open rows, like fruit trees, and, if desired, a plantation can be made to yield during its early years by growing other crops between the rows.

Not much relief can be expected from the new rubber plantations for several years, but the fact that American interests are getting into the field will probably help stabilize prices. During the past year the unusually high price has led to smuggling of raw rubber on a large scale in the Dutch East Indies, where operations of the smugglers have been as extensive and picturesque as those of the rum runners off the American coast. Native boats plying between the islands were used to run the rubber cargoes past the customs.



Where Light from the Stars Is Bright Enough for Races; Ski Slides over Snowbanks at Swiss Resort Give Devotees of the Sport New Thrills at Night

MOUNTAIN SKI RACES AT NIGHT NOVEL WINTER SPORT

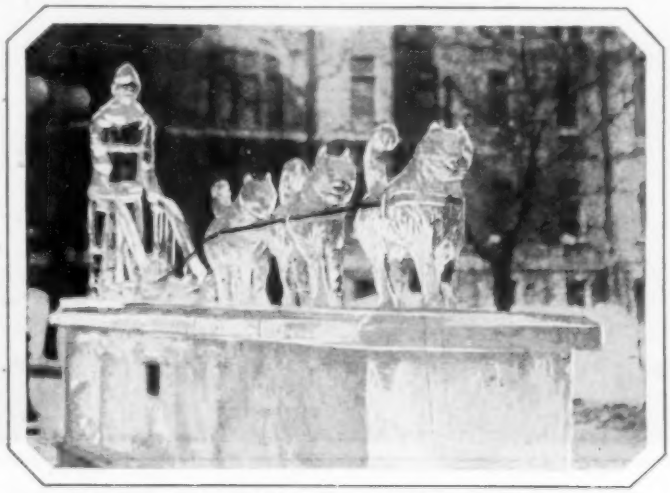
Night-time ski races furnish enthusiasts at Adelboden, Switzerland, amusement when the skies are clear. Light from the stars alone is said to be sufficient to guide the racers and they are spared the glare of the sun.

LENGTH OF GIRAFFE'S NECK FIXES ANIMAL'S VALUE

Giraffes are sold by the neck and hippopotami by the pound, annual stock taking of the animals at the London zoo has revealed. Giraffes generally are worth about $2,500. The length of the neck is a determining factor because of the difficulties in shipping. The largest hippopotamus at the London zoo is valued at $4,000, while the most valuable animal in the entire collection is an elephant which carries children on its back. Its worth is placed at $5,000. Lions average about $250 each, depending upon their size, age and disposition. Since tigers are more difficult to capture, they bring higher prices, ranging from $700 to $900. The rhinoceroses are valued next to the prize elephant, being worth about $4,500. All the animals at the zoo were estimated to be worth about $125,000.

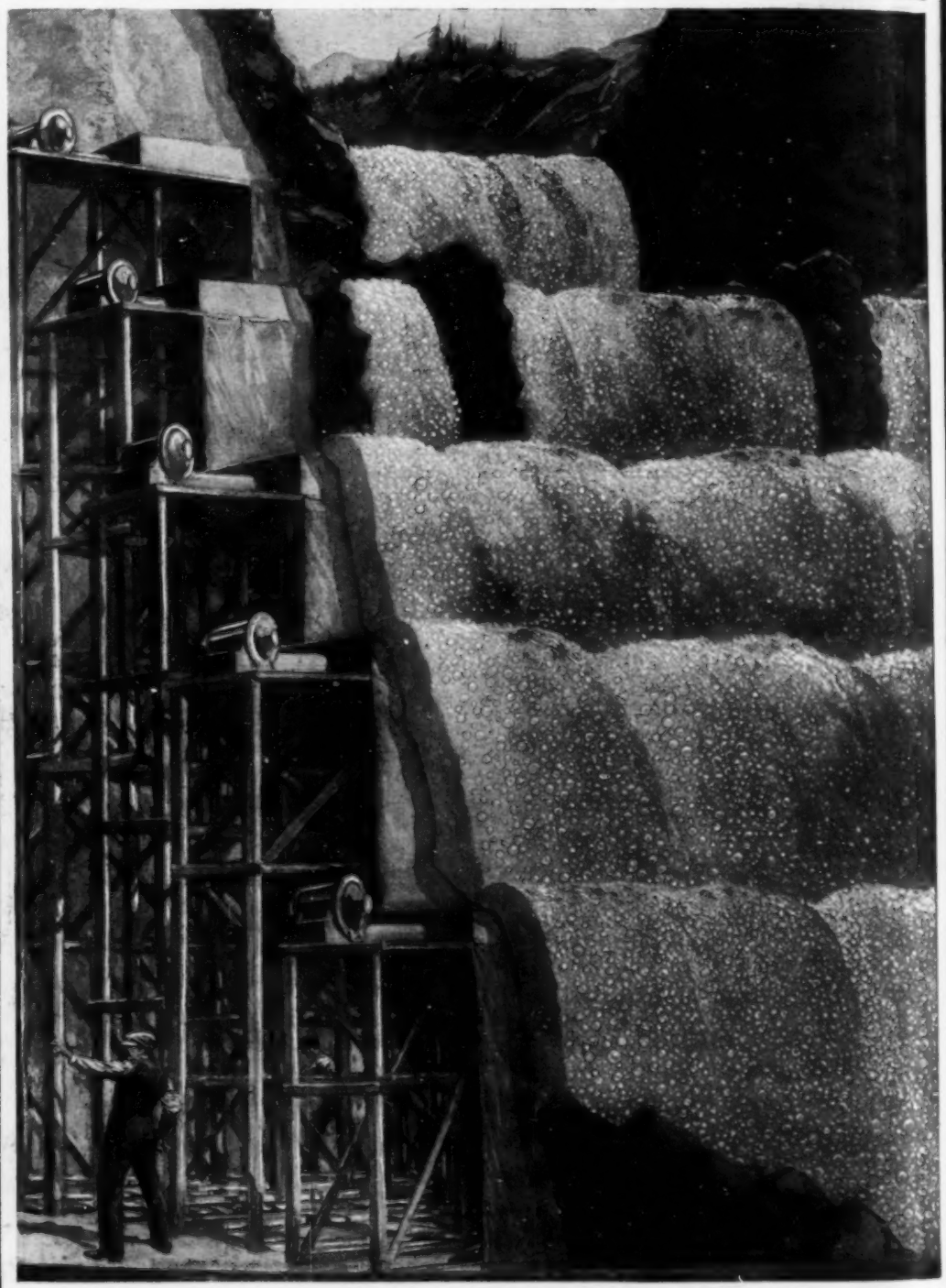
DOG TEAM CARVED FROM ICE AS WINTER STATUE

Occupying a prominent position in a Quebec park last winter, was a dog-team-and-driver statue carved from ice. The group was shown as though traveling and attracted wide attention because of its lifelike execution.



Dog Team, Driver and Sled Carved in Ice for Winter Display

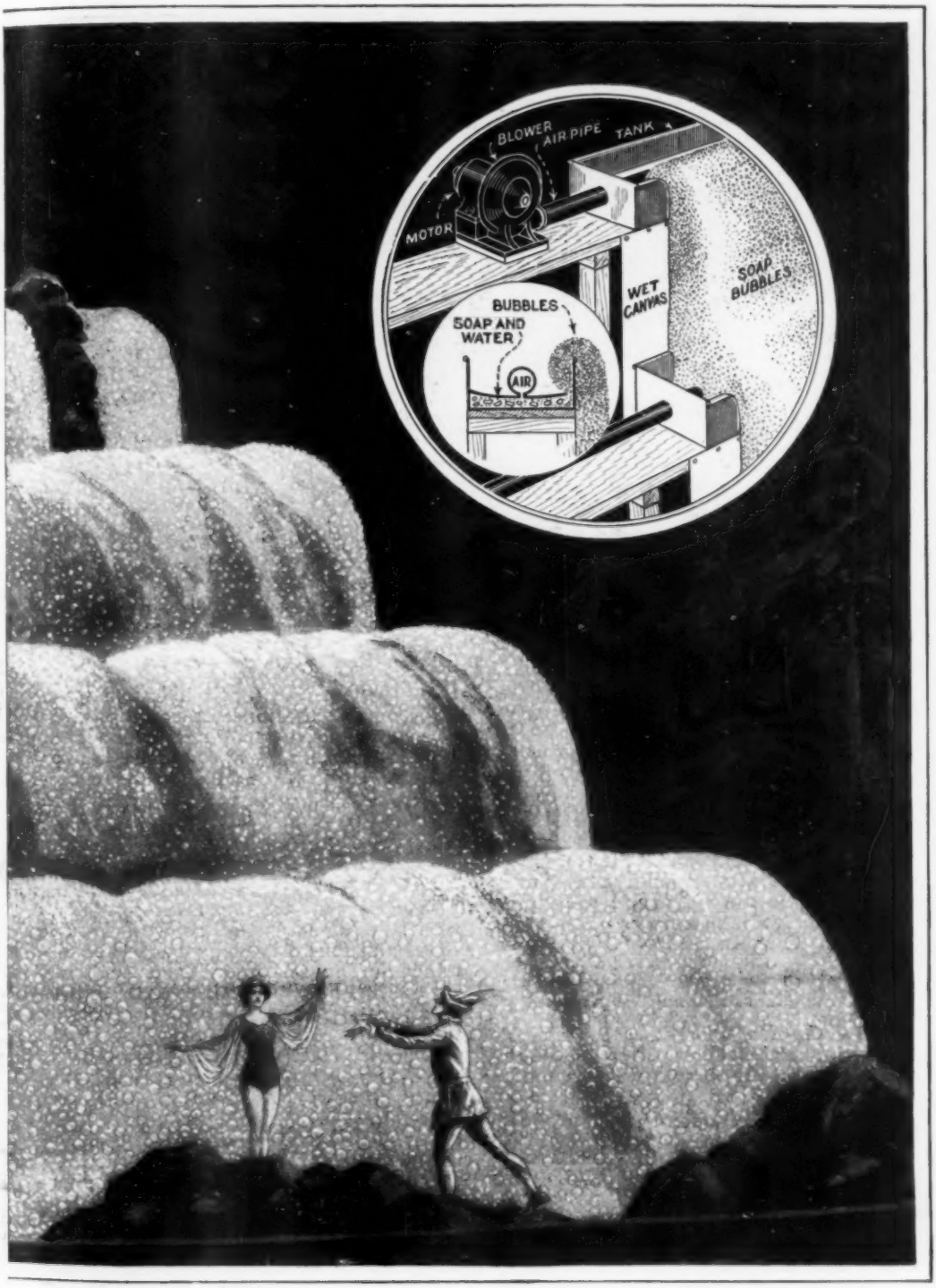
Blowing Three Million Bubbles a Second



Courtesy

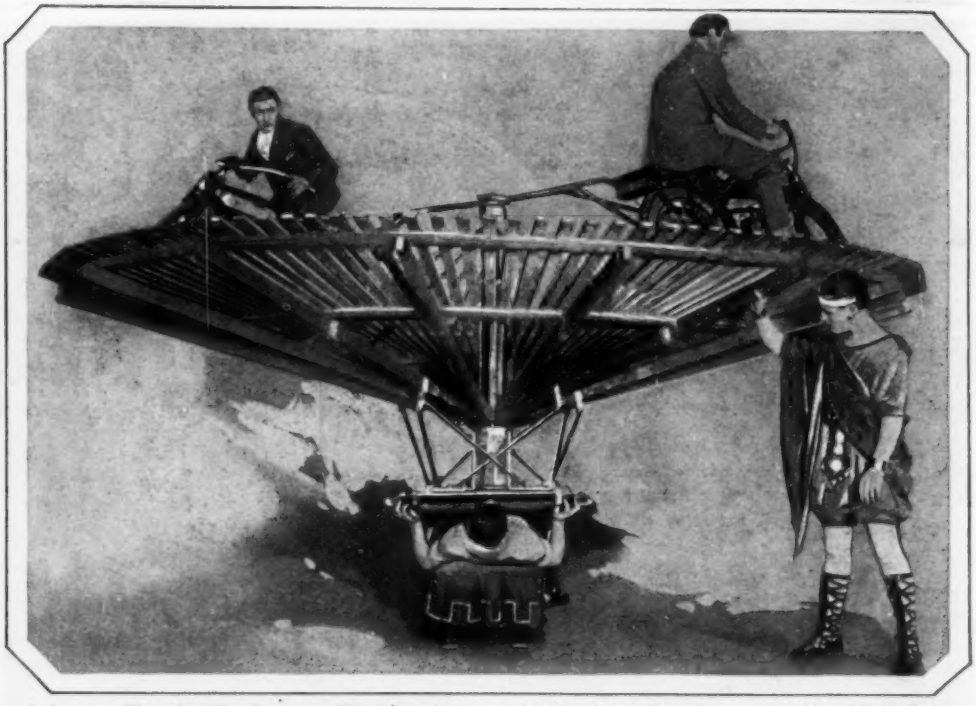
Artist's Drawing of Bubble Waterfall, Exposing Framework, Motors and Blowers, Canvas Backing and Cross Section of Bubble Cascades; Rocks Were Formed from Wire, Paper and Glue

for Mimic Waterfall on Theater Stage



Balaban & Katz

At the Foot of the Soapy Cataract, Dancers Interpreted a Story Climaxed by the Man Plunging into the Bubbles and Disappearing; Inset Shows Details of Construction



A German "Hercules" Demonstrates His Strength, Supporting Track and Two Motorcycle Riders While Lying on His Back; Cycles Are Connected to Center as Pivot to Aid in Balancing

MAN HOLDS TRACK AND RIDERS IN STRENGTH TEST

Supporting a wooden track upon which two motorcycle riders are racing, is one of the feats performed by a German strong man. Besides holding the weight, he must help balance the load under the shifting position of the cyclists and the test is one of considerable duration, as the track must be held while the riders are getting up the speed of their machines.

DESK CLAMP FOR TYPEWRITER REDUCES NOISE AND WEAR

Features of a shock-absorber and silencer are combined in a clamp to hold the typewriter to the desk. It is easily installed and adjusted, and is so constructed that the machine is held at any angle required by typewriter desks with disappearing tops. It also permits the operator to move the machine forward when using it if desired. By decreasing the jar on working parts, it is intended to prolong the life of the typewriter, reduce repair bills and spare the stenographer unnecessary fatigue. It is manufactured for different kinds of standard machines, and special clamps may be had for those with extra-wide carriages, billing devices and other machines.

ARMORPLATED INDIAN RHINOS BAGGED BY ROOSEVELTS

Specimens of the rare armorplated Indian rhinoceros, as well as royal Bengal tigers and other big game, have been obtained by Theodore and Kermit Roosevelt on their hunting expedition into central Asia for the Field Museum of natural history. They were granted permission from Indian and British authorities to enter some of the vast game preserves maintained by the rajahs after they had been successful in bagging specimens of the ovis poli and other rare game in the Pamir districts. It was in India that they found the armorplated rhinos. Some ten months were spent in the wildest and least explored regions of central Asia. At times, the hunters reached altitudes of 15,000 and 18,000 feet.

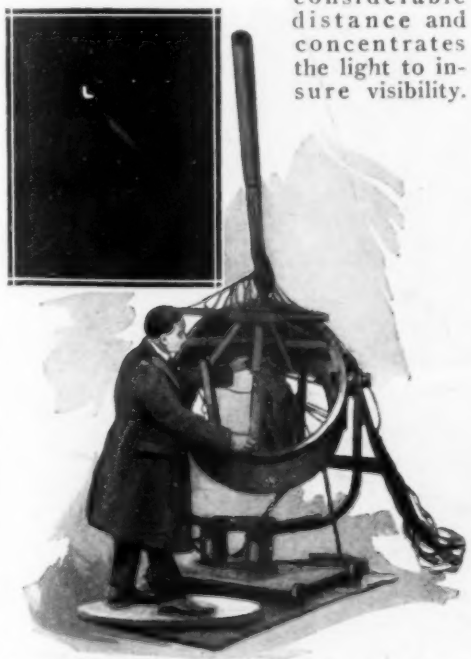
¶Instead of shaking hands, the Chinese wag their clenched fists.

STAGGERED CITY-TRAFFIC PLAN TO REDUCE DISEASE

To reduce the spread of colds and other communicable ailments in New York city, a plan of "staggering" the subway schedules was proposed to relieve congestion. The scheme involved different closing and opening hours for schools, places of business and other institutions so that the peak passenger load might be distributed over a greater period of time and keep individuals from such close contact in the cars. The plan was considered advisable especially because of the menace from smoke, unusually heavy at the time, on account of the hard-coal shortage. A similar arrangement was worked out during an influenza epidemic.

LETTERS WRITTEN ON SKY WITH SEARCHLIGHT

Using a combination reflecting and projecting apparatus, a California inventor has developed a new form of sky writing. Instead of employing smoke from an airplane, he utilizes clouds as a sort of screen upon which he throws letters from a powerful arc light. The characters are produced by the shape of the carbon. The instrument can be focused to points at considerable distance and concentrates the light to insure visibility.



Inset Shows Letter "L" as It Appears Projected on Clouds from Combination Reflector and Searchlight

Model of Los Angeles Tennis Club, Showing Arrangement of Courts and Inclosure for Tournaments

TENNIS COURTS AND CLUBHOUSE BUILT FROM MODEL

As an aid to builders of a tennis club costing more than $200,000 in Los Angeles, a "working model" of the proposed grounds, including the courts, clubhouse and swimming pool, was constructed. It was carefully planned to proper scale. One of the features of the project is a special court for tournament matches. It has bleachers for spectators, the seats being arranged to afford unobstructed view of the games from all points.

TAKE SNAPSHOTS UNDER WATER TO STUDY SHIPS

By taking under-water pictures of model ships in experimental tanks, designers are able to study the hulls as they would perform under actual conditions of use, as to rolling and other motions. This is made possible by a special method of making snapshots, developed by a Japanese. Light is furnished by exploding a "thread" of mercury under water. The material is inclosed in a narrow glass tube and sealed. Application of an electric current causes the glass to burst with light sufficiently intense to register on the negative of the submerged camera.

Big Log Split after Explosion of the Gun, and Inset Showing Instrument and Charge of Powder

GUN FOR SPLITTING CORDWOOD SAVES TIME AND LABOR

Logs as large as ten feet in diameter are quickly split into cordwood size with a special gun consisting of a steel cylinder, eighteen inches long and five-eighths of an inch across. It is tapered to a point so that it can be driven into the log and a small charge of powder, which is ignited with a fuse, is inserted in the chamber of the gun. Driving the cylinder into the log compresses the explosive. One gun is said to last long enough for splitting as much as 150 cords of wood, and only about two minutes are required to load and fire it. Practically no danger attends the operation, it is said, and wood can be split for eight cents a cord.

SIDEWALK FENCES TO SAFEGUARD PEDESTRIANS

Sidewalks and roadways would be separated by "pedestrian-proof" fences, under a traffic plan offered by an eastern engineer. Walkers could cross only by bridges or tunnels, and provision is made under the project for traffic lanes, permitting channels for vehicles going at high speed and others for slower speeds. Side entrances would be furnished a mile apart for entering or leaving. The engineer suggests that crossing streets be placed at different levels.

DOG TEAMS TAKE ENGINES' PLACE IN ALASKA

In the palmy days of Nome, Alaska, when millions in gold were being mined near by, a railroad, ninety miles long, was built to serve the district. Subsequently, with the decline in gold production, the rolling stock was sold and the rails were about to be torn up and disposed of when a group of public-spirited men intervened. Saving the line led to the use of dog teams instead of engines for hauling freight. Six or eight huskies can pull a quarter of a ton forty or fifty miles a day, it is said. After dragging the load up steep grades, the dogs climb aboard and ride down. The territory of Alaska has acquired the road, and it is now kept in repair by the territorial highway commission.

Dog Teams Bark Where Engines Puffed; Scenes on Railway near Nome, Alaska; the Dogs Ride down Grades with Passengers

Steward Must Be Able to Tell What Passengers Will Eat Each Meal during Days or Weeks at Sea

DO you know what John Smith is going to have for breakfast two weeks from day after tomorrow? Would you be willing and anxious to hazard a guess as to William Brown's choice of meat for dinner a week from Tuesday? Or have you any idea what you yourself will choose for next Monday noon's lunch?

Those are only a few of the problems that confront the men and women who keep house on the seas—the stewards of the big liners that ply between world ports. And not only must they be willing to guess the answer to such problems as this; they must also back up their decision by actually ordering their supplies accordingly, remembering always that there are no grocery stores at sea; that all passengers must be kept happy and satisfied; and, last and perhaps most important of all, that the profits of the voyage depend very materially upon their guesses being accurate, so that waste may be reduced to a minimum.

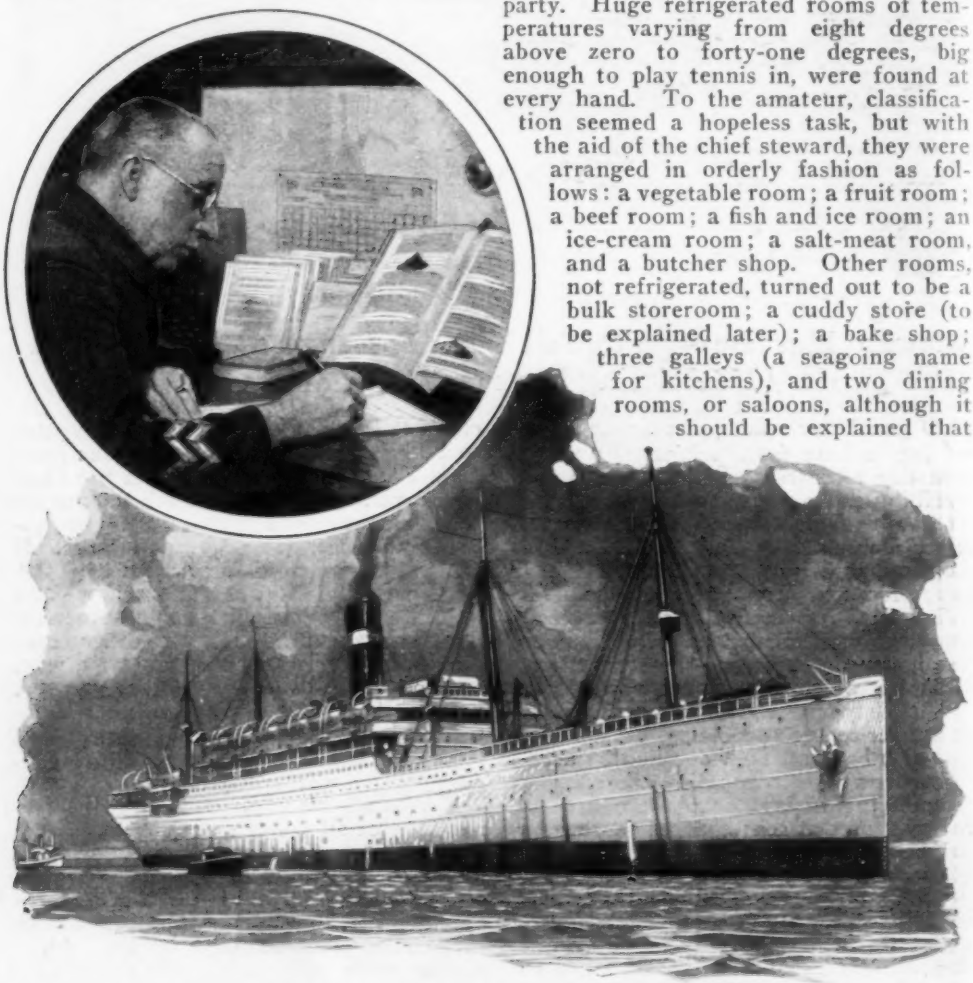
The figures in which those who keep house at sea deal are stupendous. The chief steward of a big liner orders twenty-four tons of potatoes for the voyage from New York to San Francisco via the Panama canal. with fully as much unconcern as the housewife telephones to the neighborhood grocer for a quarter's worth of the same commodity. And when the ship arrives at its destination, it will be found that twenty-four tons was precisely the right amount. Scores of other commodities are purchased in the same way, and the ship sails serenely on its journey, not at all worried by the fact that there will be no further possibility of purchasing stores until the destination is reached, nearly three weeks hence.

How is all this accomplished to the satisfaction of all concerned? With a view of finding out the answer to that question, the writer sailed out of New York harbor a few weeks ago aboard the big intercoastal liner "Mongolia," bound for San Francisco, eighteen days away. Altogether there were some 300 passengers aboard the ship. In addition, a crew of approximately 200 men manned the ship,

making a total of 500 hungry individuals to be fed, boarded, and otherwise cared for during a period of nearly three weeks. Yet so unworried by the prospect of this seemingly herculean task was the chief steward, Lewis Daughtrey, that he strolled about the deck at sailing time, greeting passengers, casually chatting with friends, and otherwise enjoying to the utmost the excitement that always attends the departure of a big passenger ship.

Out on the Atlantic, a couple of days later, with the routine of sea life settling into quiet channels, Mr. Daughtrey conducted a party of curiosity-impelled passengers down into the maze below decks to see just how sea housekeeping is effected. The first stop was made at daily-muster time, to get an idea as to just what the steward's department consists of in the way of personnel. One hundred and seventy-two men and women were found to compose the so-called "victualing department." Here is the way they are divided: sixteen bedroom stewards; six bathroom stewards; five stewardesses; seventy waiters; three bellboys; one lounge steward; three deck stewards; three smoking-room stewards; one chef and twenty cooks; five pantrymen; seven utility men; five plate washers; one chief baker and four assistants; one confectioner; five butchers; five storekeepers; two barbers and nine miscellaneous.

Personnel being thus made somewhat clearer, equipment was the next logical investigation. Down into an amazing vastness of spotlessly clean rooms went the party. Huge refrigerated rooms of temperatures varying from eight degrees above zero to forty-one degrees, big enough to play tennis in, were found at every hand. To the amateur, classification seemed a hopeless task, but with the aid of the chief steward, they were arranged in orderly fashion as follows: a vegetable room; a fruit room; a beef room; a fish and ice room; an ice-cream room; a salt-meat room, and a butcher shop. Other rooms, not refrigerated, turned out to be a bulk storeroom; a cuddy store (to be explained later); a bake shop; three galleys (a seagoing name for kitchens), and two dining rooms, or saloons, although it should be explained that



As the Steamer "Mongolia" Glides Out to Sea, Chief Steward Lewis Daughtrey, Head Housekeeper for 500 Persons on the Voyage, Prepares Menus from Cookbooks and Food Statistics

Even Better Equipped than Many Such Places on Land, a Modern Liner's Hospital Is Fitted for Handling Emergency and Other Operations of Wide Variety, and for Treating All Sorts of Diseases; at the Upper Left, Is the Operating Room, Showing a Corner of the Table in the Foreground and Sterilizer at Rear; at Right, the Dispensary Headquarters with Part of Stock of Medicines and the Steamer's Chief Surgeon; Frequently, Smaller Boats Use the Radio to Ask the Doctors of the Big Ships and Those at Base Hospitals for Medical Advice

Corner of the Men's Ward in the Hospital; It Accommodates Fifty Patients, and Is Quite Comfortable

the sea name for dining room has by no means the same significance as on land.

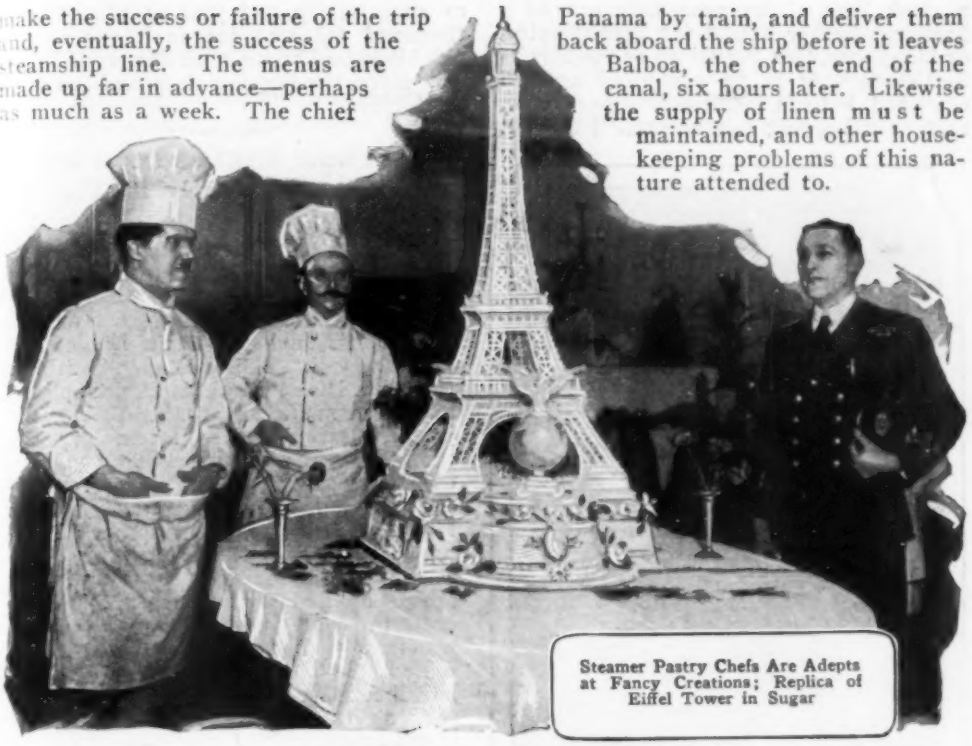
Now just how does the sea housekeeper go about determining what to purchase for his three weeks' absence from supply sources? In the first place, he has before him a chart, based on years of experience of seagoing folk, which shows the average ounces of food consumed per person per day under certain conditions. With this, and with knowledge as to the number of passengers who are making the trip, the chief steward works out a table of "meal days"—a single figure which tells him the approximate ounces of food that will be consumed on the trip. On this particular voyage, he figured that he had 24,428 "meal days," and by multiplying this figure by the number of ounces of food averaged under the conditions through which the ship was traveling, he knew what would be required in the way of food.

With this figure determined, stores are purchased accordingly. Here is where the element of chance would seem to enter. How can the chief steward tell that Ebenezer Higgins will choose bacon and not ham with his eggs a week from Saturday? The answer is simple; he can't. But he does know that, when you combine Ebenezer Higgins and 299 others passengers into one lot, a certain percentage will order ham and a certain percentage will order bacon, and that's all he cares. Of course, there is the possibility that Ebenezer will suddenly stand up in the dining room and declaim "the bacon's fine this morning," or words to that effect, and that every passenger in the saloon will order bacon. That brings in the next element to be considered—"overscale." Overscale is what has to be provided to offset unexpected upsets in the law of averages. Upon the careful calculation of overscale rests largely the financial success or ruin of the steward's department for the voyage.

And so the various commodities required for the three weeks' trip are purchased and stored away in the various rooms heretofore enumerated. The next thing to be considered is the daily menu. This is much more difficult than on land. Ashore, people are busy and engrossed in many activities. If the meal is, on the average, satisfactory, there is no complaint. But at sea, especially on a long voyage, the passenger is not as a rule busy. He plays his deck game; reads his books, and relaxes. He has ample time for contemplation of many things, including food. He is likely to be in a supercritical mood regarding his meals. Hence every precaution must be taken to insure complete variety and to cater carefully, for meals, perhaps more than any one other thing.

Corner of the Butcher Shop, as Important to the Ship Dweller as Is Its Counterpart on Shore; Below Is the Steamer's "Cuddy Store," Operated like a Grocery on Land; Various Cooks Call on the Storekeeper to Get Their Day's Supply of Groceries

make the success or failure of the trip and, eventually, the success of the steamship line. The menus are made up far in advance—perhaps as much as a week. The chief steward, upon compiling them, distributes copies to the butcher, the baker and others concerned. Here is where the cuddy store mentioned above comes into the general scheme. This is in reality a complete grocery store, with storekeepers in charge. They issue the various commodities just as does the neighborhood grocer. Each night the storekeeper, the butcher and the others render an account to the chief steward. Not only does this show the quantities issued, but also the quantities left on hand. If there is an unusually heavy drain on one commodity, menus can be arranged accordingly; similarly, an oversupply of an article can be corrected.



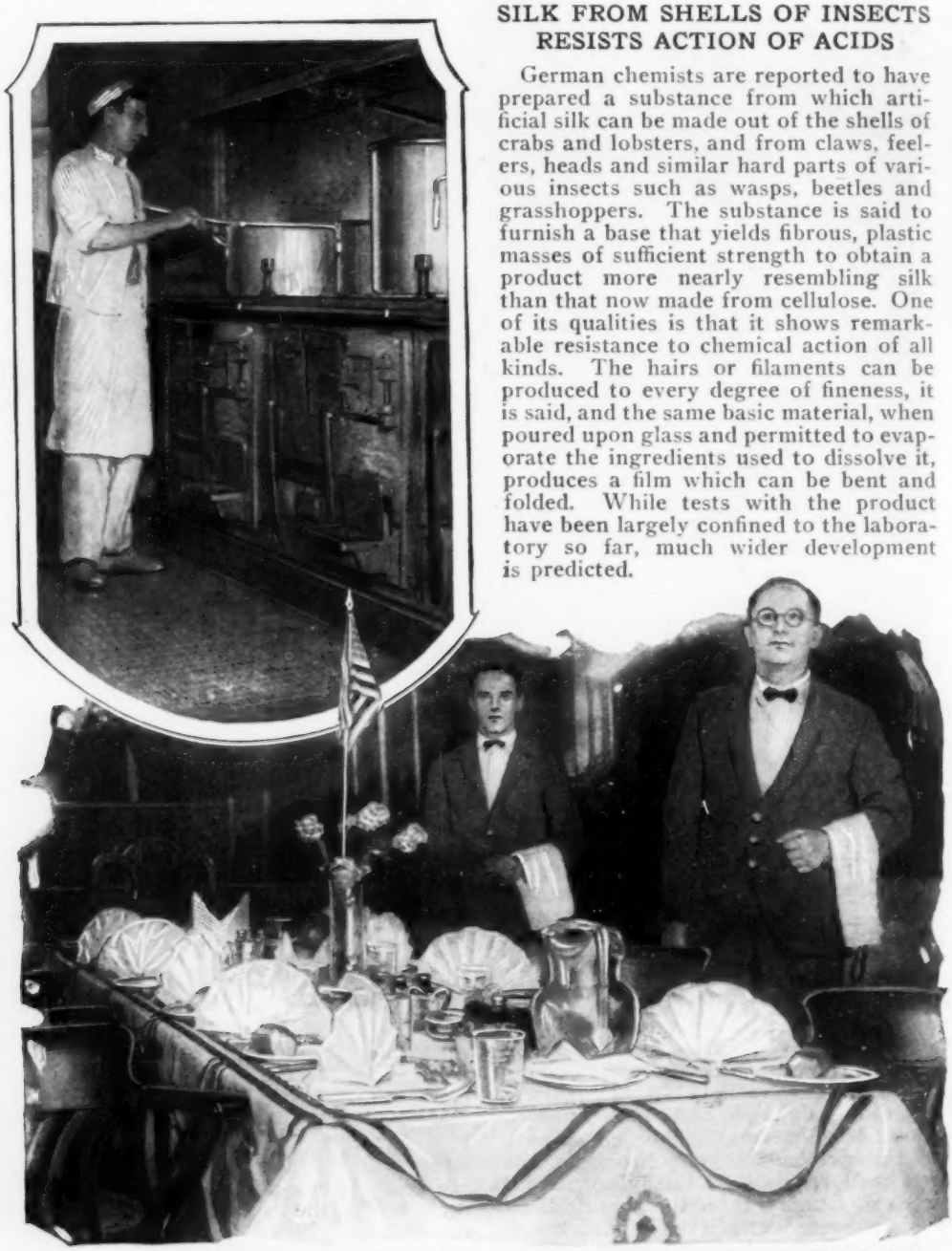
Steamer Pastry Chefs Are Adepts at Fancy Creations; Replica of Eiffel Tower in Sugar

Thus goes the problem of meals—the main consideration of the steward's department. That by no means ends his worries, however. Under his supervision come such questions as the scores of bedrooms, bathrooms and living quarters aboard the ship. Laundry, in terms of thousands of pieces, must be considered. On this particular route, provision has been made to take as many as 100,000 pieces of laundry from the ship at Cristobal, the eastern end of the Panama canal, rush them ashore by small boat; launder them; rush them across the isthmus of Panama by train, and deliver them back aboard the ship before it leaves Balboa, the other end of the canal, six hours later. Likewise the supply of linen must be maintained, and other housekeeping problems of this nature attended to.

Housekeeping at sea does not end with the steward's department, however. The medical end of the ship's welfare must not be overlooked. So the ship's doctor arranged a tour in another part of the below-decks maze. Here was found a complete operating room with the most modern surgical equipment; wards for both men and women, each capable of accommodating fifty patients; two dispensaries, fully as complete as any drug store ashore, and an isolation ward for any contagious diseases that may develop during a voyage. Nurses are part of the ship's complement.

Many other minor items are involved in successfully keeping house on the ocean. There is the ship's printer and his plant, equipped to do elaborate jobs of printing, including the daily table menus, programs for the ship's masquerade and deck-sports tournaments; passenger lists and countless scores of other odd bits of printed matter. There is the daily news, broadcast from shore stations each night, received by the radio operator, and posted frequently, so that passengers far from land are kept as fully informed as the man in the center of the metropolis with its many newspapers. There are dozens of other details involved in successful housekeeping at sea, and the net result is that, when

a sleek liner glides gracefully out of a harbor, whether bound for Southampton or Singapore, San Francisco or the Straits Settlements, it is so organized and so equipped, both in facilities and personnel, that housekeeping can be carried on just as successfully and just as efficiently a thousand miles at sea as it can in the neighborhood home, next door to the grocery store, the butcher shop and the family doctor.



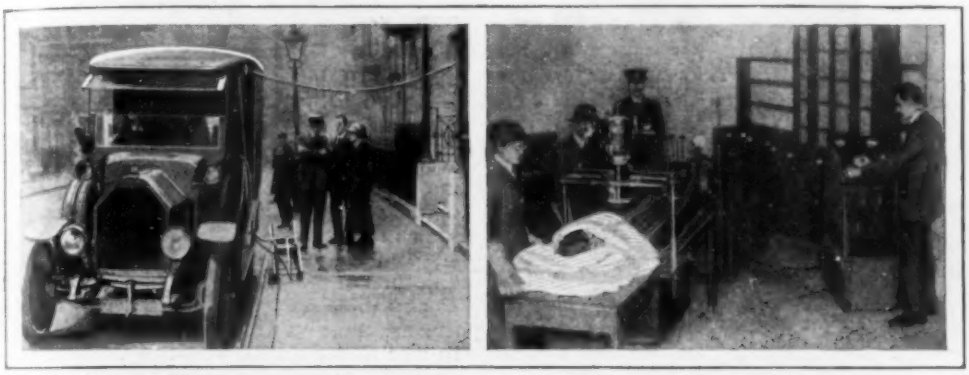
Upper View Shows Corner of One of the Ship's "Galleys" or Kitchens; Below, the Captain's Table in Main Dining Salon, Decorated with Fresh Flowers, a Luxury of Modern Sea Travel

SILK FROM SHELLS OF INSECTS RESISTS ACTION OF ACIDS

German chemists are reported to have prepared a substance from which artificial silk can be made out of the shells of crabs and lobsters, and from claws, feelers, heads and similar hard parts of various insects such as wasps, beetles and grasshoppers. The substance is said to furnish a base that yields fibrous, plastic masses of sufficient strength to obtain a product more nearly resembling silk than that now made from cellulose. One of its qualities is that it shows remarkable resistance to chemical action of all kinds. The hairs or filaments can be produced to every degree of fineness, it is said, and the same basic material, when poured upon glass and permitted to evaporate the ingredients used to dissolve it, produces a film which can be bent and folded. While tests with the product have been largely confined to the laboratory so far, much wider development is predicted.

X-RAY OUTFIT CARRIED IN AUTO SERVES PATIENTS AT HOMES

Use of the X-ray in determining the extent of injuries, and in various other diagnoses, is considerably extended by means of a portable outfit which has appeared in London. It permits taking photographs of patients in their homes, saving costly and sometimes disastrous removal to hospitals or laboratories. The entire equipment is carried in an automobile. Parts necessary for use at the bedside are taken into the house and connected to the main apparatus with a cable. The doctor telephones necessary instructions to an operator in the automobile while the photograph is being made. The exposure is then developed in a special darkroom compartment in the rear of the automobile.

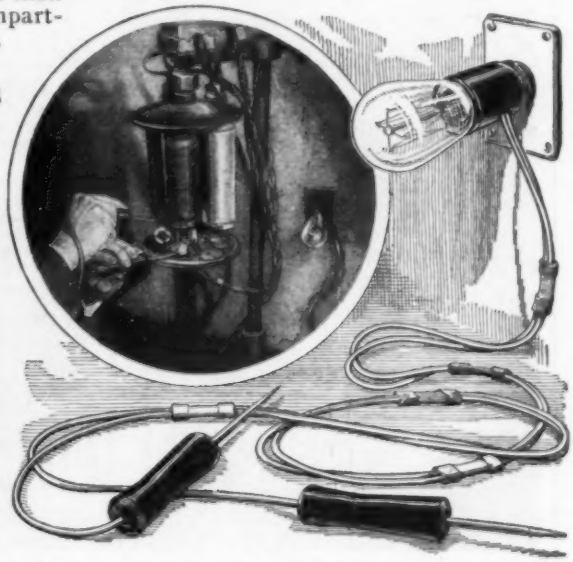


Courtesy London Illustrated News

Portable X-Ray Outfit in Use; Truck Is Driven to Patient's Door and Apparatus Taken to Bedside for Making Photograph While Operators Keep in Contact by Phone

TROUBLE FINDER SERVES ALSO AS CHARGER

For locating open or short circuits, and other obstacles to the operation of a wide variety of electrical equipment and wiring, a testing set now on the market is easy to use and is quickly put into service. It consists of a pair of testing handles with removable caps so that different sizes and lengths of lead wires may be inserted, two points of a special alloy intended not to break or corrode, and a special socket with separable plug that fits any standard lamp socket using either alternating or direct current. Positive evidence as to the location and nature of the trouble is afforded as the light used with the testing set is illuminated or fails to burn. Different sizes of lamps are used according to the kind of test involved. The outfit can be used with a rectifier in charging wet radio B-batteries by connecting one test point to the lead electrode of the rectifier and running a jumper from the aluminum electrode, to the positive post of the B-battery. The other test point is connected with the negative post of the battery. The current is then turned on, the size of the lamp used as resistor depending upon the number of cells in the battery. To charge a twelve-cell battery, for instance, requires the use of a forty-watt lamp, while a sixty to seventy-five-watt bulb is needed for a twenty-four-cell battery.



Electric Testing Outfit in Use and Drawing of Its Parts, the Lamp, Cable and Two Points with Insulated Handles

Double Camera for Long and Close Shots; Upper Instrument Is Turned by Motor

DOUBLE MOVIE CAMERA TAKES LONG AND CLOSE SHOTS

Saving the need of two tripods and two photographers, a double motion-picture camera is expected to simplify the making of films, especially in panoramic work. One of the cameras is cranked by hand while the other is turned electrically. Perfectly matched negatives are thus obtained at the same time, one instrument being set for close-ups and the other for longer shots. This arrangement greatly helps when panoramas of more than 180 degrees are taken, as two cameras under such conditions come within photographic range of each other, thus spoiling one of the negatives.

ROOF OVER FOUR BUILDINGS PLANNED FOR AIRPLANES

What effect will aviation have on city architecture? That it gives promise of modifying skylines and causing the development of special types of buildings is seen in a series of sketches submitted in an eastern competition to meet the requirements of landing fields for airplanes in city districts. The plans are based on the assumption that planes will be able to rise and descend vertically, the much-desired feature now being sought in helicopters of various designs. The prize-winning sketch involves the use of high, terraced buildings acting as huge supports for the landing roof proper. These buildings would stand on a plot about 1,400 feet square and would rise like towers to a height of 950 feet. There would be one tower on each side of the plot. All would be covered by a superstructure, intended to rise 300 feet above the tops of the supports and provided with a level, thirty feet below the landing roof proper, for repair shops, waiting rooms and other accommodations for passengers and mails.

Prize-Winning Sketch of Landing Fields for Airplanes in City Districts

Granite Peak, near Harney, in the Black Hills of South Dakota, from Which Gutzon Borglum Plans to Carve a Statue of Washington, Tall as a Twenty-Story Building, and Sketch Showing How the Carving Will Be Done

Photos © Publishers' Photo Service

Nation's Parks Lure Auto Tourists Westward

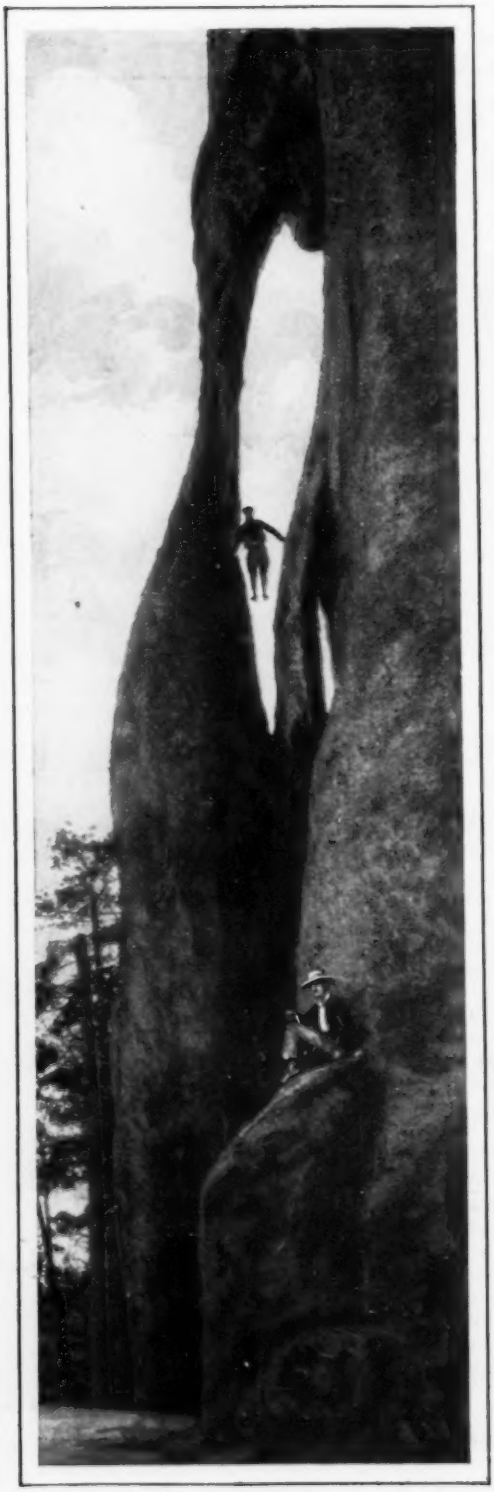
Millions Tour Each Summer Famous Scenic Spots of the Rockies Where Auto Roads Have Succeeded Pack-Train Routes

SOME millions of automobiles between the Atlantic and Pacific are being tuned up this spring for the annual migration to the scenic wonders of the west. There are three or four million cars in California and the western states, a large number of which are near enough to the national parks for week-end trips. Added to these are several hundred thousand which make the overland trip each year from the east and middle west.

The main roads to the Yellowstone, Yosemite, Glacier and Grand Canyon parks take the bulk of the travel, but constantly increasing numbers are turning aside to the less widely known, smaller, but often more beautiful small parks, both national and state, and to the historical spots throughout the west.

The project started by Gutzon Borglum, first sculptor of the Stone Mountain memorial near Atlanta, for 200-foot-high statues of the builders of the nation—Washington, Lincoln and Roosevelt—in the Black Hills of South Dakota has awakened interest in one of the most picturesque spots in the west. The Black Hills region is famous for its grotesque buttes, queerly eroded cliffs and nightmarish stone mountains, all on a gigantic scale. Off the usual traveled routes, and forming, as they do, an orphan range, their nearest mountain neighbors being the Big Horns of the Rockies, far to the west, they have escaped the worst effects of too much development and too much tourist traffic.

Within the region which is to be made famous by Borglum's statues lies the little town of Custer, where the noted general made his headquarters just prior to his last fight, and the town of Deadwood, famous as the wildest and woolliest mining camp of its day. Around about them are the Wind cave and Jewel cave parks, Custer state park, many small caves, sylvan lakes, tree-clad mountains, and, dominating all, the vast time-scarred granite buttes, rising in strange peaks and pillars. At Harney peak, near the Needles, where the Borglum statues are to be carved, the fire rangers' station, on Lookout summit, is 7,340 feet above sea level, the most siz-



able mountain height east of the Rockies. The top of the gigantic Washington statue, more that 200 feet high, will be almost as high up as the tallest peak in the Rockies, while from a level with the eyes of the first president, the visitor, on a clear day, can look out over the three states of South Dakota, Wyoming and Montana for a distance of 200 miles, and even see the famous Devil's Tower, over near Sundance, Wyo., one of the strangest rock formations outside the Garden of the Gods. Some 600 feet high and nearly a mile around at the base, its eroded sides rise straight up for most of their height, flaring in at the top and out at the base. Round the sides it is grooved by time and storm in a series of gigantic pillars, five-sided, as a rule, and over six feet thick.

Like most of the natural wonders of the region, it is explained by an old Indian legend, which claims that three Indian maidens, out picking flowers, were attacked by a gigantic grizzly. They sought refuge on a low hill and, when the bear pursued them, the gods caused the rock to grow up out of the ground. The bear climbed and climbed, but the rock kept on growing until finally the exhausted animal slipped back and was dashed to death below. The Indian maidens then made ropes of their flowers and lowered themselves to the ground. The deeply eroded marks in the sides of the rock were left by the bear's claws, the legend explains. The Indians still believe that, during storms, the thunder god takes his drum to the top of the peak and beats it.

The fastnesses of the Black Hills country were the home and hunting ground of the Sioux tribe long after white men had opened the main traveled trails to Oregon to the south. West of them, in the Devil's Tower country, were the Crows, and through the hills the two tribes fought their wars.

Custer, Sitting Bull, Wild Bill Hickok and Calamity Jane, have left their stamp on the district. At Deadwood, where Wild Bill was killed, he is buried on Boot Hill, and near by is the grave of Calamity Jane.

The Custer state park is not so large as some of the national parks to the west, but embraces many of the features of Yellowstone, both in natural scenery and big game. Herds of buffalo, elk, deer and bands of big-horn sheep roam its meadows and peaks. In the region between the Cheyenne and Belle Fourche rivers there is as variegated scenery as any place in the country may boast.

The caves rival those in other famous cave sections. Wind cave, a national

monument, was discovered by a cowboy roaming the hills when he was attracted by the whistling of the wind through the entrance, which has since been much enlarged to afford easy ingress to tourists. More than a hundred miles of its passages, studded with glittering crystal formations, have been explored. Jewel cave, not far away, boasts 1,500 chambers of mystic beauty. Miniature lakes and weird crystals built up through the centuries give each a distinctive charm.

To the southwest, the national Old Trails road, embracing the famous Santa Fe trail, opens up the land of the Hopi Indians and the cliff dwellers to tourists, along with the Grand Canyon, petrified forest, the artists' colony at Taos, New Mex., and side trips to the parks around Denver. The snake dance at the Hopi village attracts an increasingly large attendance each year, despite the long drive across the desert on a most primitive road.

Motor roads in many of the mountain states are excellent. Those through the Black Hills have not only been carefully built, but were designed to give the maximum of scenic enjoyment.

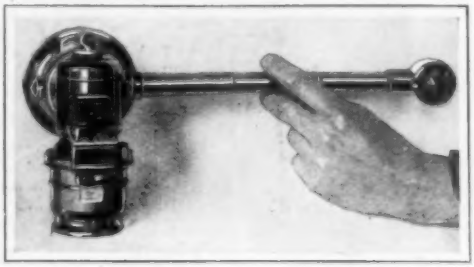
Boots and Broad Skis as One Protect the Sportsman's Legs and Feet and Simplify Mastery of the Healthful Amusement

BROAD SKIS FITTED WITH BOOTS KEEP FEET WARM

Roomy boots of a leatherlike material are attached to toboggan-shaped skis now on the market to keep the feet warm and to give a more secure footing. They snap and fasten about the legs, to keep snow from sifting in, and there is a foot harness within each boot. Being wider than the ordinary type, the skis are said to afford more riding power over deep fluffy snow. They are made in varying widths and lengths, the pair shown in the illustration being eight inches wide and four feet long.

HEAD AND REAR LIGHTS IN ONE SAVE EXTRA LAMP

With a telescopic tube at the side, a headlight, for bicycles or for use on automobiles, eliminates the need of a separate lamp for the rear. A red lens at the end of the tube glows from the reflection of the headlight. The extension may be closed during the day or when it is not needed. It collapses, fitting close to the side of the larger lamp.



Combination Head and Rear Light; Extension Is Illuminated by Reflection from Large Lamp

¶The name Siberia means "thirsty."

ATHLETES ROLL INSIDE WHEEL TO EXERCISE MUSCLES

Exercises at a physical-training school in Germany include periods with a unique wheel in which the athlete stands and makes complete revolutions by pushing

Sport and Beneficial Exercise in Novel Combination, Rolling inside Hoop Brings Many Muscles into Play and Develops Balance

and bracing against the rim. His feet are secured in sandal-like supports and he holds to the opposite side of the wheel with his hands. Grips are so arranged that his fingers will not be scratched or bruised as the wheel turns for they are on the inside of the frame. The task of rolling the apparatus in this way, is said to exercise many muscles that do not receive development with other kinds of equipment. It may be used indoors or out.

GAUGE LIGHT'S CANDLEPOWER WITH GREASED PAPER

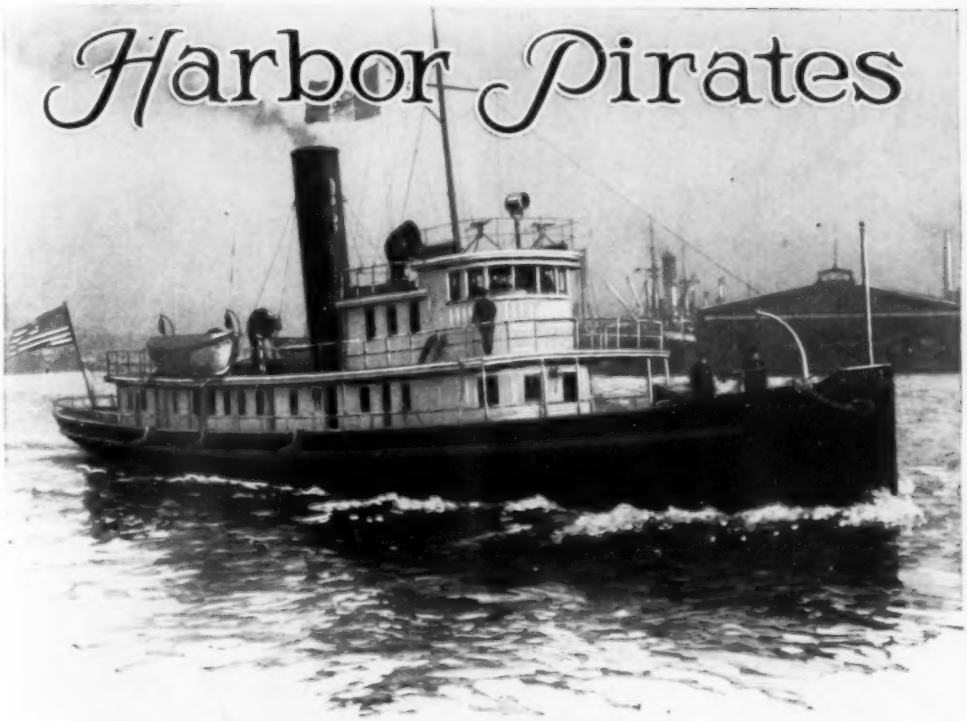
Rating of candlepower of light is based upon a standard "candle" which is specified by a British law that deals with gas and electric-lighting undertakings. It provides that the candle shall be a uniform one made from spermaceti or whale oil, weigh six to the pound and burn at the even rate of 120 grains an hour. In measuring with this standard, a thin sheet of special paper in the center of which is a waxed or greased spot is used. The paper is held upright in a frame and on either side, at the exact level of the greased spot, is placed the standard candle and the one to be tested. Both lights are then moved backward and forward until the greased spot is no longer visible on either side of the paper. When this occurs, it is known that the lights diffused on each side of the paper are of equal strength. The standard candle and the one being tested are probably at different distances from the paper. The former may be only a foot away while the other may be four feet. If it is, its light is four times as strong as that of the standard candle and since it illuminates sideways as well as lengthwise, the distance must be squared to give the full measurement, or sixteen candlepower, of the tested light source. However, since the standard candle, no matter how carefully made, is not always entirely reliable, the measurements now are usually made with a lamp which has a light emission equivalent to that of ten standard candles.

AMBULANCE FOR SICKLY DOGS TENDS PETS OF POOR

Medical care for the pet dogs of poor persons in London is now given at one of the public dispensaries. The animals are collected in a special ambulance fitted with compartments that hold them securely without injury and to prevent shock and jars in case they are wounded.

Placing a Dog Patient in the Ambulance; the Carrier Has a Special Folding Top to Hold Occupant Securely

Harbor Pirates



By FLOYD TAYLOR

PIRATES in New York harbor cost the shipping industry $1,000,000 a year. Life on the Spanish Main was dull compared to that of a modern river pirate in New York, and Captain Kidd was no more careless with other people's property than those who follow him in 1926.

These assertions were made at a meeting in New York of the Maritime Exchange committee on marine and waterfront property. At the meeting shipping men, and men representing the city, state and federal governments, decided on forming a committee to determine means of fighting the pirates.

Some skeptical persons were inclined to doubt that pirates could operate in the midst of millions of people, in a harbor carefully protected by police boats and the coast guard, but the records show that these thieves are active, ready to use their guns and successful in robbing craft under way and ships and barges tied to docks. Here is a case of harbor piracy:

Twelve men in a fast motor launch tied up one night to the stern of the steamship "Bridgeton," lying at a Brooklyn pier. They climbed aboard without the knowledge of the crew. At about 11:00 o'clock, a sailor walked aft and was seized and bound. The pirates, wearing rubber-soled shoes, crept forward. Not a member of the crew knew anything was wrong on board until he was grabbed, had a gag thrust into his mouth and was bound with hard thin ropes cut from the lifeboat davits. The prisoners were locked up in the mate's cabin.

The last man taken by the pirates was the watchman on duty in front of the ship's strong box. He was manhandled so that he had to spend the next few days in a hospital. The custom officer on duty on the dock was seized as well as the assistant engineer, who had been on shore leave and returned to the ship while the pirates were working.

The twelve bandits cut through the heavy steel hinges of the ship's safe with an acetylene torch, which they operated under cover of a tarpaulin. Their loot consisted of precious metals valued at $12,000. There was one box of platinum and two boxes of unrefined gold and silver dust, the remnant of a metal cargo valued at $150,000. When the pirates had emptied the strong box, they escaped in the motor launch.

Piracy flourished in New York harbor especially during the early part of the

View of East River above Brooklyn Bridge at Right, the Type of Waterfront in Which the Harbor Pirate Works; Piers for Railroad Barges Back of Warship

World War, but the police got it under control for a time. Some years ago it flared up again, and now ship owners say it is as flourishing as in the days when pirates strung their victims to the yardarm or bade them walk the plank.

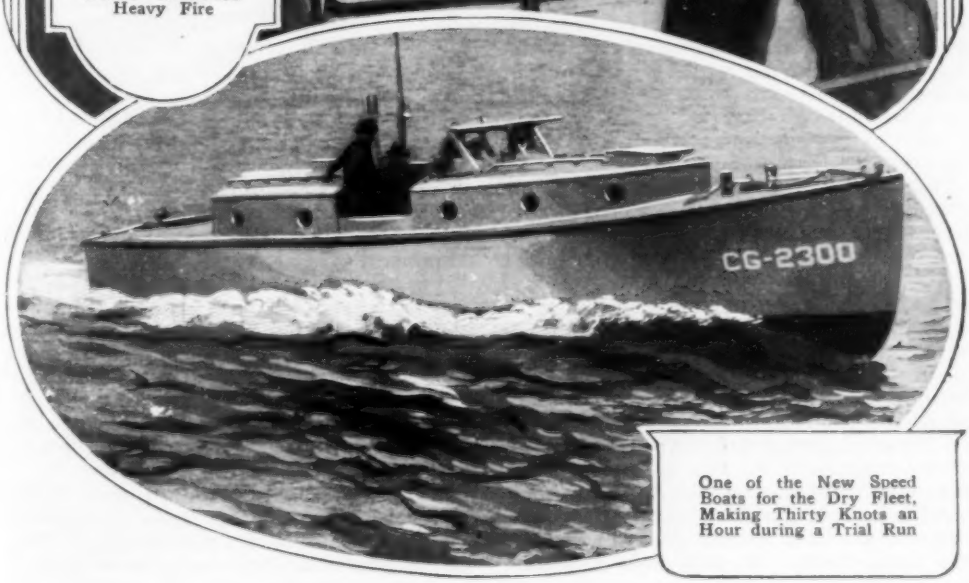
The river pirate will steal anything from a piece of rope to ten tons of coal. He usually works from a motorboat of from fifty to a hundred horsepower. A few of the boats are equipped with Liberty engines and some of the harbor pirates also engage in rum running. Some of them have deserted piracy for rum running or to "high-jack" the rum runners, but their places have been filled by other criminals.

A long string of coal barges started at night, in tow of a tug, from a coal pocket on the New Jersey shore of the Hudson, bound for a Manhattan dock. On the tug there was the usual crew of twelve men and on each of the barges a captain to tend to the lines and act as watchman. Five river pirates in a dull-gray boat, with racks carrying rifles and revolvers and with bullet-proof glass in its portholes, followed the string of barges as they plowed along at three or four miles an hour. In mid-stream, the pirates ran their craft above the last barge, cut out the motor and allowed the boat to drift down on the barge. A moment later three shadowy figures plunged through the darkness against the barge captain. He was gagged before he could cry for help.

While he was stretched bound in his cabin, the pirates shoveled ten tons of coal to the deck of their boat. In the morning they sold it to peddlers on New York's east side, or to coal dealers in some small town on the waterfront near New York.

Cargoes are stolen from barges at their piers. The pirates will take anything that is salable, lumber, wool, hides, coffee, tea,

Custom Agents Inspecting an Armored Motorboat Shelled by Machine Guns Before Being Captured and Relieved of Its Contraband Cargo; Bullet-Proof Glass Withstood Heavy Fire



One of the New Speed Boats for the Dry Fleet, Making Thirty Knots an Hour during a Trial Run

Towing Coal Barges Past the Statue of Liberty; Like Sea Robbers of Olden Times, Harbor Pirates Sometimes Plunder These Craft While in Motion

silk, sardines, canned fruit or even the ropes that tie the barges to the docks. Barges have drifted into the harbor to be wrecked by passing ships or go aground as a result of harbor thieves taking their ropes. The rope on one barge is worth several hundred dollars.

The barge companies cannot afford to arm their vessels and employ special police, the shipping rates are too low. The marine division of the New York police department does its best and occasionally breaks up bands of the pirates, but its task in guarding more than 500 miles of waterfront is a tremendous one.

In addition to the passenger ships and freighters in the harbor, the police have to guard thousands of barges, hundreds of tugboats and an endless list of small craft. One of their jobs is to catch rum runners. The coast-guard force protecting the harbor is well equipped with high-speed boats. Its main work is to capture the rum runner, who may be a pirate on the side, but the guard is ready to go into action against the pirate who is not a rum runner if necessary. Some time ago a watchman on a Jersey pier saw two men climbing aboard a railroad barge, weighted down with cars containing valuable shipments. He shouted at the men as he drew his revolver. The reply was a bullet that passed through his coat. He emptied his revolver at the pirates as they dropped to the deck of the motor launch and sped away from the dock. The crews of a police boat and a coast-guard vessel heard the shots and gave chase. The pirates opened up their engine to the limit and roared down the river.

The police boat was outdistanced, but the coast-guard chaser gained gradually and opened fire with a machine gun. One of the pirates knelt in the stern of his boat and tried to pick off the machine-gun

A Rum-Running Craft Comes to Grief; Captured after a Battle at Dawn off South Brooklyn, a Fifty-Foot Cabin Cruiser Being Unloaded of Its 150 Cases of Whisky

crew with a rifle. The pirate craft shot into the Buttermilk channel between the Brooklyn shore and circled Governor's island twice, with the gun battle continuing. The chase was ended when the motor of the coast-guard boat suddenly broke down.

One of the most highly organized gangs of river pirates that ever fought for loot in the harbor was broken up a few years ago by the police. In the trial of several of the men in the federal court, it was charged that they had stolen goods worth $6,000,000 from ships, barges and railroad cars in riverfront yards, in the years 1919 and 1920 alone.

Forty-eight men charged with being members of the gang were indicted in June, 1920, and during the next year, twelve of them pleaded guilty. Two ringleaders and two minor members of the gang were convicted in 1921, the specific charge being the theft of 375 bolts of worsted from a freight car in May, 1920. The United States attorney told the jury in the case that the pirates had maintained regularly a fleet of three barges and four launches in the river and had train crews in their employ on every railroad entering the city. On the river, the prosecutor asserted, the members of the gang either bought the collusion of barge captains and watchmen, or forced them by threats to permit thefts. The gang disposed of its stolen merchandise in the south, and the amount was so great it affected the market price in some localities.

During the winter of 1921-1922, a fleet of 164 shipping-board steamships, anchored in the Hudson river at Peekskill, was looted of furnishings and supplies valued at $400,000. Secret-service men believed that most of the loot was carried from the ships across the ice to shore after the river had frozen. Most of the ships were fully equipped before they were looted and some were almost stripped of furnishings by the pirates. Among the articles taken were brass deck fittings, engine-room brass and copper, table linen,

silverware and bed linen. The river pirates sometimes work from shore when they believe this method offers them a better chance of escaping, but most of their robberies are from the water.

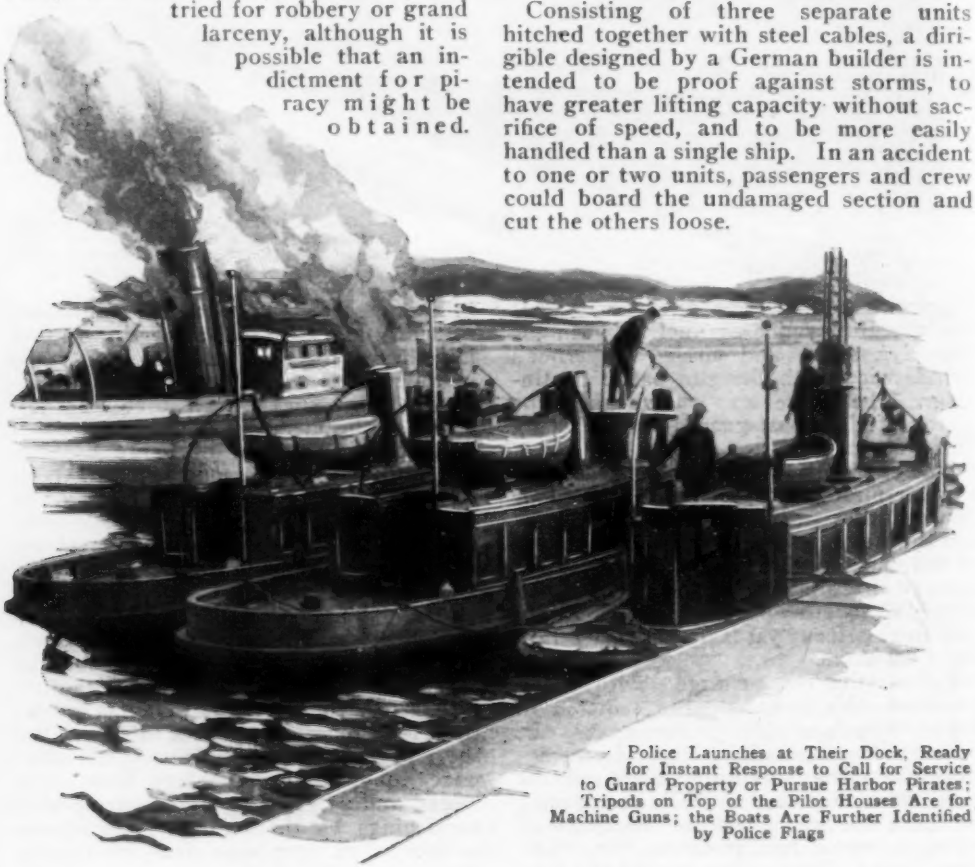
Five watchmen were inadequate to protect $100,000 worth of opium which arrived from Turkey in a shipment to a New York druggist. Three of the watchmen were on a pier at which the ship was tied up, at the foot of Congress street, Brooklyn. The three were captured by eleven young river pirates and bound with wire. The other two watchmen were overpowered near the storeroom where the opium was kept. The pirates went directly to the place where the opium had been put, picked up the cases and walked away. They were out of sight before any of the watchmen could wriggle from his bonds. On one side of the pier the steamship was moored and on the other side there were two lighters, but neither the members of the steamship crew nor the lighter captains heard the pirates at work. The pirates who are captured usually are tried for robbery or grand larceny, although it is possible that an indictment for piracy might be obtained. There is confusion in the law, and prosecutors hesitate to attempt to get convictions for piracy because the penalty is death and juries in New York are known for hesitancy in bringing verdicts which mean the death penalty. Under the revised statutes of the United States, it seems harbor pirates might be convicted.

The most vicious of the criminals in the harbor are the rum runners and high jackers who prey on the former. When these engage in piracy, the police-patrol and coast-guard boats must be prepared to fight heavily armed men in launches whose speed equals the best of those of the protectors of the harbor. Some of the rum boats are armored with steel and have portholes of bullet-proof glass. Several of them are converted submarine chasers.

Take it all in all, the marine police believe the saying that "the policeman's life is not a happy one," is right.

BIG DIRIGIBLE IN THREE UNITS FOR ADDED SAFETY

Consisting of three separate units hitched together with steel cables, a dirigible designed by a German builder is intended to be proof against storms, to have greater lifting capacity without sacrifice of speed, and to be more easily handled than a single ship. In an accident to one or two units, passengers and crew could board the undamaged section and cut the others loose.



Police Launches at Their Dock, Ready for Instant Response to Call for Service to Guard Property or Pursue Harbor Pirates; Tripods on Top of the Pilot Houses Are for Machine Guns; the Boats Are Further Identified by Police Flags

Gutzon Borglum with Models and Cast of Proposed Cowboy Statue for Texas

BRONZE MEMORIAL TO COWBOY TO STAND NEAR THE ALAMO

Resting on a granite base, twenty feet high, a bronze memorial to the cowboy of pioneer days, designed by Gutzon Borglum, will depict a scene from the range, two cattlemen on horseback with part of a herd of longhorns at the side and rear. Other views from the days of the cowboy will be represented on panels at the foot of the monument. The bronze figures will be fourteen feet high. The statue, which will stand near the famous old Alamo, at San Antonio, Tex., is expected to cost in the neighborhood of $100,000.

FIVE HUNDRED KINDS OF WORK OPEN TO AMERICAN WOMEN

From a study of the employment conditions of more than 340,000 women in the past seven years, the women's bureau of the department of labor has found that female workers are now admitted to 537 different occupations in this country, or all but thirty-five of the total number listed by the census reports. The survey shows that there has been a steady decrease in the number of women engaged in domestic and personal-service activities, while the greatest increases have occurred in the clerical and professional occupations. It was found that seven out of every ten single women who live at home give their money to their parents, getting back for themselves only what can be spared after the family needs have been met. The reports showed that about four out of every five women in industry are single. According to Miss Mary Anderson, director of the bureau, industries are being found which offer women not only a living wage and opportunities for advancement, but which base the pay on the job itself and not on the worker's sex.

BLOWER FOR BURNING GASES REDUCES FUEL BILLS

Easily installed in front of the ash-pit door, a blower unit for furnaces that burn small sizes of anthracite coal, is said to increase greatly the efficiency of the fuel, as it ignites gases that ordinarily do not burn but pass up the chimney and are wasted. It is so arranged that the extra supply of air it affords is heated and provides the necessary oxygen for the combustion of the gases arising from the fuel bed. No changes are necessary in the grates or dampers of the ordinary furnace for installing the blower, and its use permits burning small sizes of coal that could not be practically consumed without it.

¶Our Bureau of Information will answer all questions regarding articles appearing in this magazine.

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For Faster Mail Deliveries; Operating Combination Letter Facer, Stacker and Stamp Canceler in Washington Post Office

LETTER STACKER AND CANCELER SPEEDS HANDLING MAIL

Letters are stacked, faced and canceled in a continuous operation by an improved device installed in the post office at Washington. It was designed by an expert in the department and is expected to save much time and many dollars annually in handling Uncle Sam's vast mail. Its chief development over other devices of the kind is the canceling feature. Formerly, after the letters had been faced, that is, arranged uniformly as to back and front, and stacked, the stamps had to be canceled in a separate machine. All three steps are now accomplished in this one unit. Tests have shown that it has a capacity of nearly 130,000 letters a day. It is practically automatic in operation, men being required only to feed the letters to the mechanism.

GRINDSTONES FORM WALL, CHURCH AND ROADS

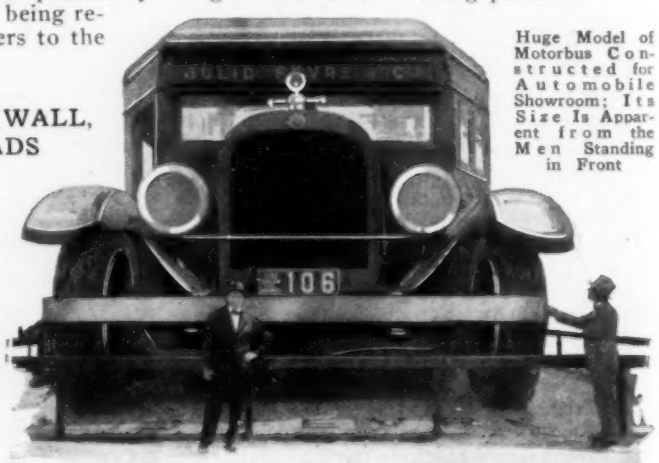
Hundreds of old grindstones discarded by a large eastern tool works were broken up and used to build a wall around the plant, and more than 2,500 of them were shaped to fit into a church structure. Those that could not be employed in building were used as foundation material for roads within the area occupied by the factory.

STATIC FORECASTS FOR RADIO FANS NOT POSSIBLE

In reply to numerous requests for the service, the weather bureau has announced that predictions concerning static conditions cannot be given to radio fans with any degree of certainty. According to Prof. C. F. Marvin, chief of the bureau, only insufficient studies of static have been made so far, and to go into the subject deeply enough to justify forecasts, would require increased facilities and the expenditure of large sums. If the research were undertaken, the scientists would attempt to establish the relation between the reception of radio signals and meteorological conditions over a considerable period of time and, on the basis of data, issue daily radio-forecast bulletins.

MODEL OF GIANT MOTORBUS SERVES AS SHOWROOM

As a display room during an automobile exhibition, a South American dealer constructed a huge replica of a motorbus. It was 100 feet long, the wheels were over nine feet in diameter and, over all, the bus was thirty-seven feet high. Space was provided for showing more than 100 touring cars. The designer did not reproduce engine and other working parts.



Huge Model of Motorbus Constructed for Automobile Showroom; Its Size Is Apparent from the Men Standing in Front

Clothing the Flying Man

For the Seagoing Flyer, the Air Service Provides a Fur-Lined Non-Sinkable Suit Which Affords Both Warmth and Safety in Event of an Accident While Flying over Water

By TRUMAN B. MILLS

ACCORDING to Chinese tradition dress was originally for ornament. The protective factor was probably given scant consideration. Thousands of years of experience in clothing ourselves have established for us the proper apparel for everyday use in the different seasons, but no such experiences can be drawn upon by the flyer in working out clothing for himself, since the airplane is less than twenty-five years old.

If adornment came first and protection last in determining the kind of clothing worn by our ancestors, the procedure has been reversed in the development of the clothing for the aviator, for at present comfort is the principal factor. A visit to the equipment section of the Air Service at McCook field, Dayton, Ohio, gives an insight into the latest developments in clothing for air navigation. R. C. LaVan, who is in charge of the experimental work in clothing, declares that new discoveries of value to the flyer are being made constantly.

For instance, he declares, practically every kind of hide of domestic and foreign fur-bearing animals has been experimented with in determining the best lining for the winter suit of the aviator. And as a result of these experiments it has been found that the skin of the fawn reindeer makes the best lining.

Mr. LaVan has a large chest in the laboratory, in which are stored a variety of pelts of beauty and varying degrees of utility from the backs of the Australian and Tasmanian opossum, the gray wolf of the north, the common muskrat, the wolverene of Michigan, the Chinese sheep and goat, the hair seal, and other fur bearers. All have been put through tests to find out their serviceability, and wherever they have been found useful, they have been incorporated into some part of the flyer's attire or equipment.

In developing a suit, the engineering division meets the same difficulties as do other branches of the government as regards cost. A nutria-lined winter suit costs around $250, so efforts are being made to develop a suit without the customary fur lining, in the hope of reducing the cost. Nutria is the skin of a South American animal.

One of the new experimental suits has an outer shell of cape leather (domestic sheep), an inner lining of chamois, and a lining next to the body made of single blanketing. This is said to be warm, durable, of light weight, and, last but not least, comparatively low in cost. Many of the winter suits have an outer shell of half Bedford cord and half leather. The leather is from the waist up. Bear hide has been used for lining suits, but it is not

satisfactory, because the hairs stand out when the hide gets cold. Wolverene hide is the best for standing the cold. The skin will not freeze and the hair will not become frosted from the breath. This fur is used extensively on the sleeves of parkas, worn in the Northland.

Fur-lined gloves, moccasins, helmets and sleeping bags are other items in the cold-weather equipment of the aviator. Gloves lined with northern-wolf fur are standard equipment with the winter clothing. The right-hand glove is often slit across the palm, permitting the aviator to thrust out his hand for writing, without removing the glove.

The moccasin worn by the aviator would bring a sigh from the American Indian, who was a great artist at designing this form of foot covering. It is seventeen inches high and made of moose and elk hide. The lining is of fur. One of the best-looking helmets used is made of coon skin. Another interesting helmet is for the accommodation of radio receivers.

Although elaborate clothing must be worn in cold weather, the summer suit is very simple. The best one developed so far is of worsted gabardine. This material is treated so that it is absolutely waterproof. One of these was given a twelve-hour water test at McCook field, the arms and legs being tied shut and water placed inside of the body of the garment. At the end of the twelve hours, the water was poured out and the suit was found to be perfectly dry.

There is still another article of clothing that is proving a boon to all who do any flying over water. That is the unsinkable suit. Previous to the designing of this equipment, a flyer wore a vest, or vest and coat, lined with a cottony substance called kapok. These garments proved to be too bulky, so a substitute was sought. The suits now used are lined with so-called "Chicago foam," a spongy rubber, very light and non-absorbent. The ordinary sponge rubber absorbs water, but the foam may be kept under water for days without taking up any moisture.

A special suit was developed recently for altitude work. It has an outer shell of cape leather, a lining of chamois, another lining of blanketing, and an inner lining of fawn reindeer. This suit weighs sixteen pounds. It is made to keep the flyer warm in a temperature of seventy degrees below zero.

Electrically heated clothing may be worn by flyers, with electrical pads in the shoes, gloves, over the shoulders, and at various places around the body. It is the tendency, however, to get away from electrical heating and develop clothing that will keep in the heat of the body and keep out drafts.

The two-piece winter suit shown in one of the pictures tells a tale of the clothing designer's effort to get a garment that conforms somewhat to civilian styles in dress. It is made with a heavy nutria-lined coat and trousers of goat fur. When the flyer makes a landing near a city and wants to appear dressy and conventional, he just pulls off the goat-skin trousers, and is then attired in the regulation army trousers, making him look less like an eskimo.

Fur-Lined Moccasins and Mittens, the Latter with an Ingenious Slit in the Right Palm to Free the Fingers for Writing, and a Fur-Lined Helmet with Built-In Radio Head Receivers

Top, Left, Lieut. John MacReady, in His High-Altitude Suit, and, at Right, with Oxygen Tube in His Mouth; Two-Piece and Non-Sinkable Suits Below

Photos by Courtesy of U. S. Air Service

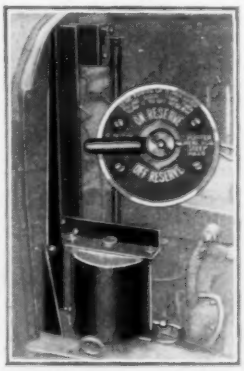
Views of the Vacuum Ballast Cleaner Showing Suction Pipes for Both Sides and Middle of Track

BALLAST CLEANED BY VACUUM TO SAVE HAND LABOR

Operated by steam from a locomotive, a huge vacuum cleaner sucks up ballast, cleans it and returns it to the track at the rate of a thirty-three-foot rail length every three minutes. Dirt and ballast are thrown against a screen within a huge tank in the apparatus by means of a partial vacuum created with a steam-driven fan. This screen is set at an angle of about fifty-five degrees, permitting the refuse to fall to the bottom of the tank. The sifted ballast falls to the forward part of the tank where it is caught in small hoppers and finally reaches the track within a few feet of the place from which it was taken. The suction pipes, of which there are three, two for the outside of the track and one for the space between the rails, have telescoping joints so that they can be raised or lowered. Steam for the operation of the equipment is furnished by an ordinary locomotive, which pushes the vacuum cleaner. Steam is also used in a small engine on the front end to operate the valve mechanism through which the ballast is returned to the track after it has been cleaned.

EXTRA GAS TANK FOR AUTOS AIDS IN CLIMBING HILLS

Motorists are provided with an extra supply of fuel in an emergency tank which may be installed under the hood of the car. It is filled automatically when gasoline is put into the main tank and is controlled by a pointer on the dash. It is designed especially for automobiles having the fuel tank under the front seat and is intended to eliminate the necessity of backing the car up steep hills when the normal fuel supply runs low. The container holds enough fuel to run the auto five to seven miles, is securely bolted to the car frame with stout angle-iron supports and admits the gasoline directly into the feed line when the pointer control is turned to the proper position.



¶Twenty-six days were required for the trip of the first steamer to cross the Atlantic ocean.

REFUGE FOR BIRDS ON MISSISSIPPI

For the protection of all kinds of wild fowl, birds and animals, a preserve is being established on both sides of the Mississippi river, beginning at Rock Island, Ill., and extending north for a distance of approximately 300 miles. This tract was chosen largely because the river valley is the main airway for migratory birds. The refuge will be limited to the bottom land that lies between the river and the bluffs, which, at places, rise to a height of 400 feet. Hunting and fishing will be permitted here under restrictions. The land is now being acquired from part of an appropriation of $1,500,000 for the project made by congress. The new reservation—when fully developed one of the largest in the world—will be known as the Upper Mississippi River wild life and fish refuge and be under control of the U. S. biological survey.

Runner Breaking the Tape at End of Sprint a Few Yards Ahead of Speedy Whippet Which Was Gaining Steadily

RUNNER IN RACE WITH WHIPPET WINS BY ELEVEN YARDS

In a feature race between a sprinter and a whippet in California, the man won by eleven yards, but he had the advantage of a seventy-five yard handicap and the dog was gaining on him at the finish. The distance run was 200 yards with the lanes marked as in a regular contest.

SNOW MELTED BY HOT ROLLER TO SAVE SHOVELING

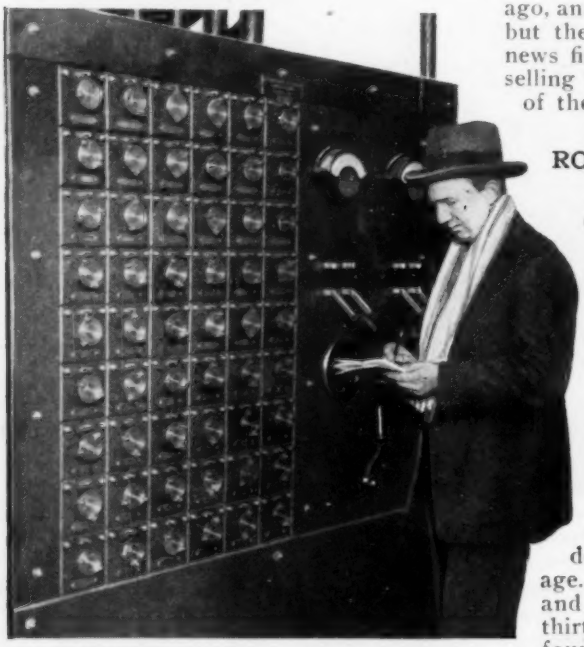
To reduce the cost of snow removal in large cities, and to do the work more rapidly, an eastern inventor has demonstrated his solution of the problem, a huge roller propelled by a motor truck and which may be heated to 2,000 degrees Fahrenheit if necessary. According to reports of a test of the roller in New York city, after a heavy storm, the outfit quickly dissolved the snow.

Melting Snow with Huge Roller Pushed by Tractor; Drum Can Be Heated to Temperature of 2,000 Degrees Fahrenheit

FRESH-WATER SPRING IN OCEAN DISCOVERED OFF FLORIDA

Five miles off the east coast of Florida, a fresh-water spring with a flow estimated at several million gallons an hour, has been discovered by officers of the hydrographic survey. The water was found rising at considerable velocity above the surface of the sea. Small boats were pushed away by the force of the current and when a bucket was lowered, the crew had no difficulty in obtaining a day's supply of pure, fresh drinking water. The spring issues from layers of rock under the bottom of the ocean and is more than 150 feet deep, by about twelve feet in diameter, although the floor of the sea at this point is but fifty feet below the surface.

TRAFFIC-LIGHT CONTROL BOARD REGULATES SIGNALS



Where Lights Governing Traffic of Chicago's "Loop" Are Controlled; the Main Switchboard in City Hall

One of the features of the newly installed automatic traffic-light system in Chicago's "loop" district is the central control board located in the city hall. From this unit, intervals between the signals may be changed with little difficulty, if circumstances demand the alteration. Forty-nine street intersections are governed by the system, which is not synchronized as in most installations of this kind, but so arranged that the length of the "stop" and "go" intervals is greater or less at some crossings than at others, depending upon the condition of traffic.

PLATINUM DEPOSITS IN AFRICA START NEW FORTUNE RUSH

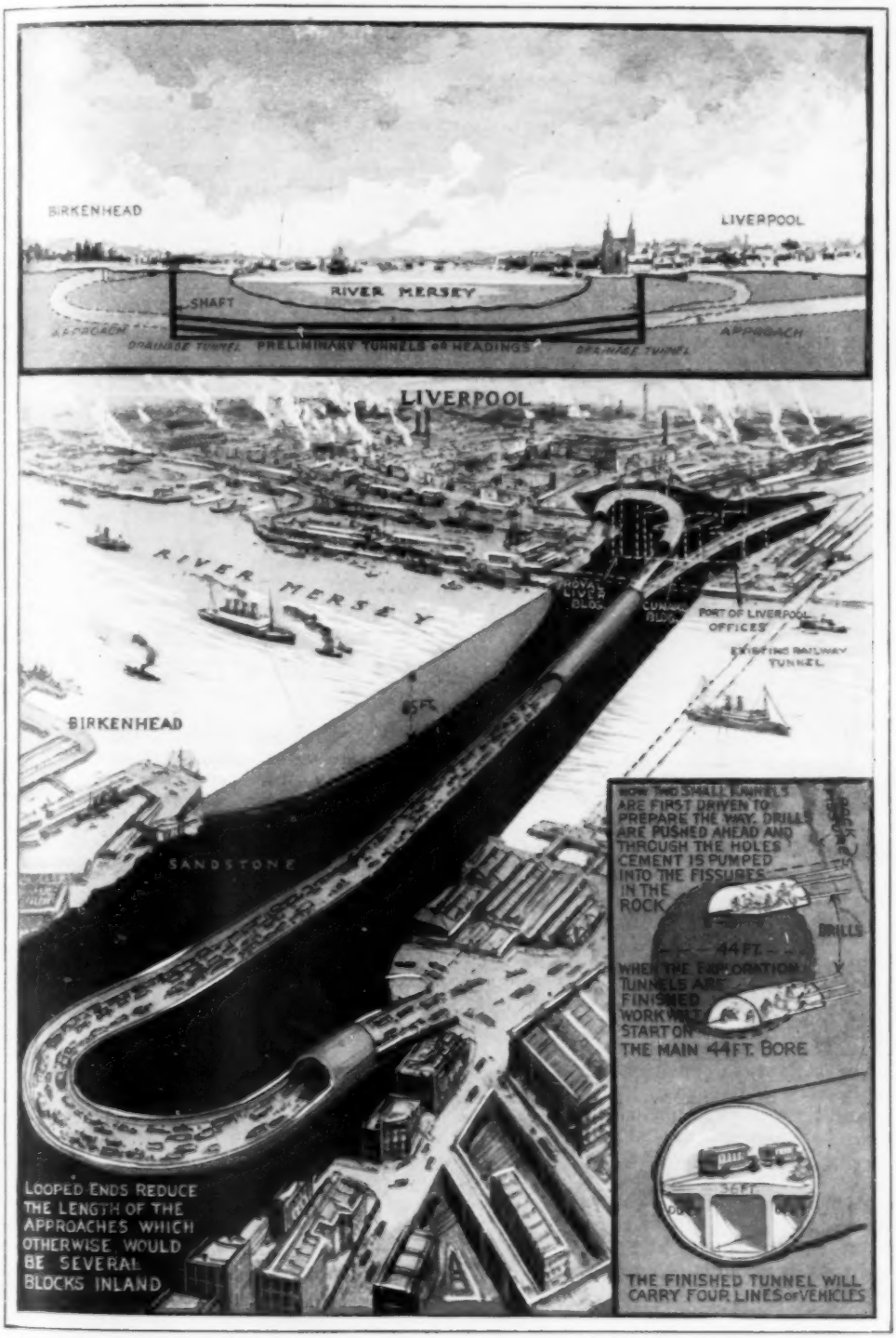
Discovery of platinum in South Africa has attracted a rush of miners, who like the dauntless adventurers of Klondike days, have penetrated remote parts of an unsettled country, far from railroads and navigable streams, in search of the rich deposits that are believed to be contained in an area of 2,000 square miles in the Transvaal. The hazard of malaria fever adds to the dangers of the rush and machinery must be carried through the jungles by pack. To find the metal, deep shafts must be sunk. Platinum was discovered in the district about three years ago, and richer deposits unearthed in 1924, but the finds were kept secret until the news finally leaked out. With the metal selling for about $125 an ounce, the lure of the new fields is naturally strong.

ROCKS SEALED WITH CEMENT AID TUNNEL BUILDERS

Compressed air drills are thumping under the Mersey river in England as workmen drive shafts through the rock to connect Liverpool and Birkenhead by a vehicle tunnel which will shorten the journey between the cities and speed up traffic. Preliminary small passages are being constructed first, and as the work proceeds, holes are bored into the rock and these are filled with cement to seal the strata so that work on the main tunnel can be done without the hindrance of seepage. The finished tunnel will be a mile and seven-eighths long; the roadway, thirty-six feet wide, will accommodate four lines of vehicles, and there will be three entrances, two in Liverpool and one in Birkenhead. Spiral approaches reduce a steep ascent and, like the auto tunnel under the Hudson river in New York, the Mersey shaft will be thoroughly ventilated to carry away exhaust fumes from the motors.

BOWLS OF RUBBER FOR BULBS CAN'T BREAK OR SCRATCH

Pliant rubber bowls in classic design and various colors are now on the market for growing flowering bulbs. The advantages of their use are that they retain their shape, cannot break and will not mar the furniture. Furthermore, since they are soft and unaffected by moisture, they are not likely to cause stains on any surface upon which they may be placed.

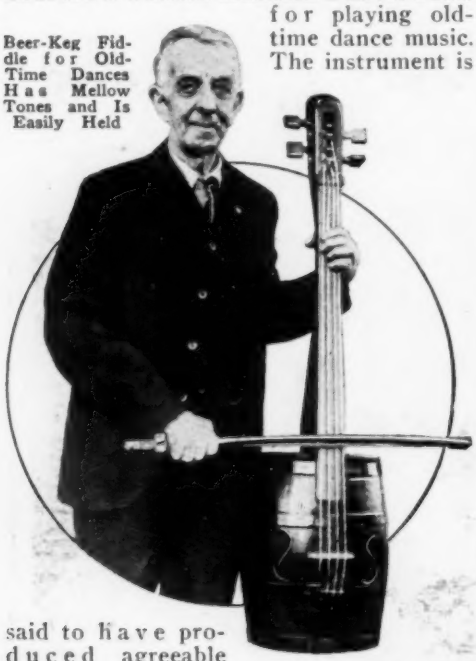

BIRKENHEAD
LIVERPOOL
SHAFT
RIVER MERSEY
APPROACH
DRAINAGE TUNNEL
PRELIMINARY TUNNELS or HEADINGS
DRAINAGE TUNNEL
APPROACH
LIVERPOOL
RIVER MERSEY
PORT OF LIVERPOOL OFFICES
EXISTING RAILWAY TUNNEL
BIRKENHEAD
SANDSTONE
LOOPED ENDS REDUCE THE LENGTH OF THE APPROACHES WHICH OTHERWISE WOULD BE SEVERAL BLOCKS INLAND
NOW TWO SMALL TUNNELS ARE FIRST DRIVEN TO PREPARE THE WAY. DRILLS ARE PUSHED AHEAD AND THROUGH THE HOLES CEMENT IS PUMPED INTO THE FISSURES IN THE ROCK
DRILLS
44 FT.
WHEN THE EXPLORATION TUNNELS ARE FINISHED WORK WILL START ON THE MAIN 44 FT. BORE
THE FINISHED TUNNEL WILL CARRY FOUR LINES OF VEHICLES

Copyright, The Graphic

Cross-Section Drawing Above Shows Preliminary Tunnels in Relation to Main Passage; General View of Entire Subway in Center, and at Right, Diagrams Illustrating Method of Construction and Plan

FIDDLE WITH BEER-KEG BACK PRODUCES CLEAR TONES

Strings stretched over an old beer keg as a sounding board and carefully tuned, afforded a western musician a novel fiddle for playing old-time dance music. The instrument is said to have produced agreeable tones and was made ready for use with a few odd pieces of wood.



Beer-Keg Fiddle for Old-Time Dances Has Mellow Tones and Is Easily Held

OIL FROM FOSSIL FISH DEPOSITS FOUND IN TEXAS

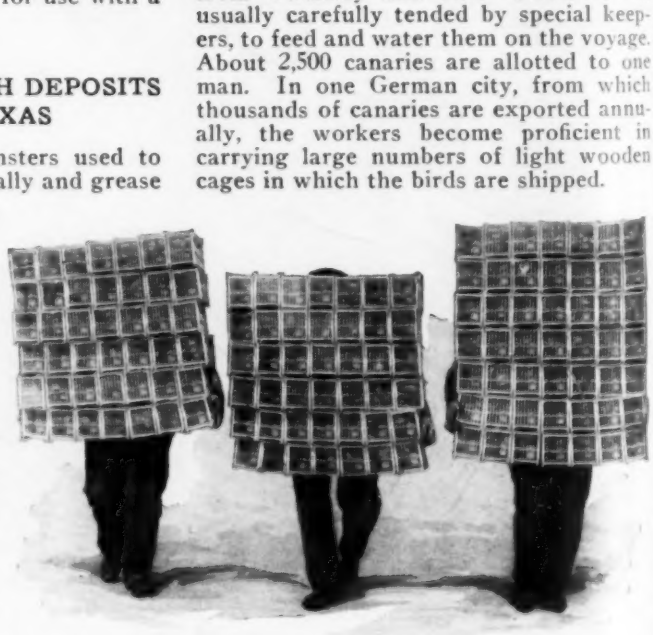
Near Burnet, Tex., teamsters used to stop their wagons occasionally and grease their axles with an oily substance that seeped from the ground. Recently, it has been discovered that this substance comes from a large deposit of prehistoric fish or marine animals, which produces, upon distillation, an oil known as ichthyol, valued as a curative agent in the treatment of various skin diseases. The deposit is from two to seven feet deep and extends over nearly 2,000 acres. It rivals the natural source discovered some years ago in Germany. That country had a monopoly on the oil, and during the war, prices rose from $5 to $80 a pound. From the shale in which the substance is found may be derived a base for paint, shellac and varnish. Sodium, zinc, ammonia, silver, gold and platinum are also found, and fertilizer can be manufactured from the residue, it is said. Perfumes and a synthetic gunpowder can also be made, according to reports. Experts who have examined the valley estimate that there is enough of the deposit to last the United States 600 years.

MOVING DUMMIES FOR TAILORS REPLACE LIVE MODELS

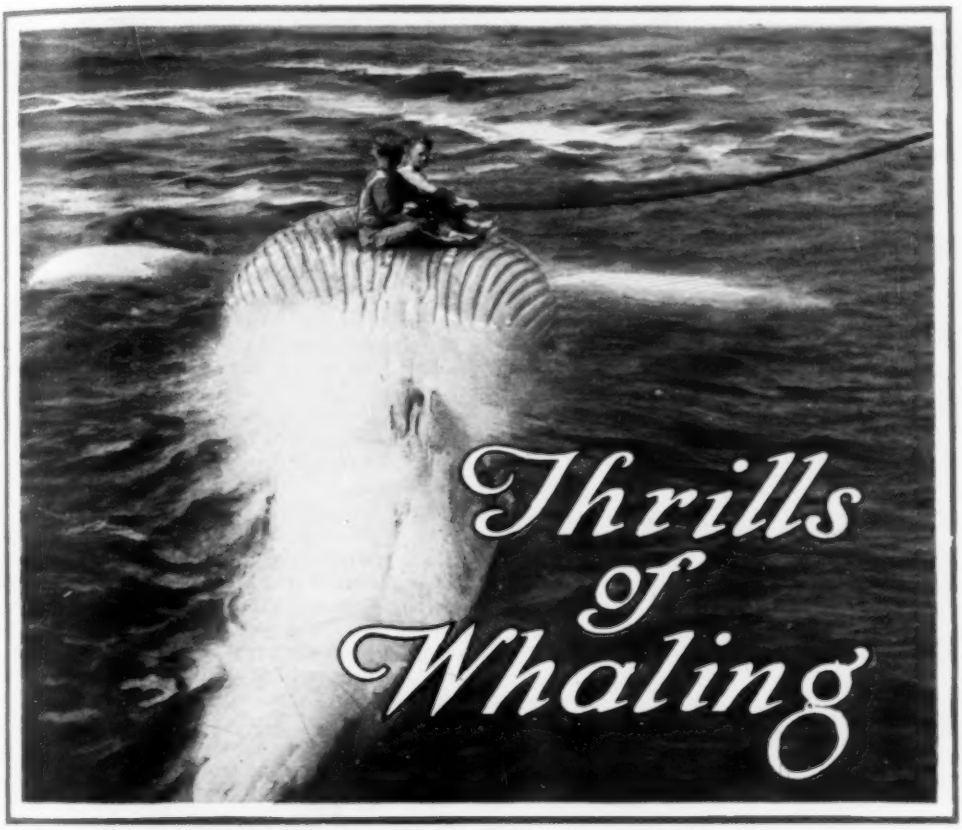
Automatic models that move their lips, eyes and heads, by means of electric motors hidden in their chests, have appeared in Paris tailors' windows. They are being used instead of the conventional wax and live figures and in a wide variety of shapes and sizes, corpulent, small, plain-featured and otherwise more closely resembling some of the actual persons for whom the costumes are intended. The faces are composed of fiber and plaster.

"NURSES" ATTEND CANARIES ON OCEAN VOYAGES

Canaries shipped into the United States from Germany and other countries are usually carefully tended by special keepers, to feed and water them on the voyage. About 2,500 canaries are allotted to one man. In one German city, from which thousands of canaries are exported annually, the workers become proficient in carrying large numbers of light wooden cages in which the birds are shipped.



Expert Cage "Toters" Employed at German Canary Farm



Whales Are Often Towed to Port, Instead of Being Cut Up at Sea, Since the Addition of Air Compressors on the Steamers Enables the Crew to Inflate the Carcass and Prevent Sinking

By FRANK B. HOWE

THE spectacular, thrilling and highly profitable profession of whaling, almost a lost art during recent years, has come back into existence and permanency with the discovery that the waters of the Pacific off Mexico, Lower California, and even the west coast of the United States offer an almost boundless field to whaling expeditions.

So thickly inhabited is this region that during the season just ended, a Norwegian fleet of three vessels, operating off the upper Mexican coast on an experimental basis to determine the value of these waters from a whaling viewpoint, obtained 298 whales. When it is considered that whales average in the neighborhood of eighty tons each, it is easy to realize the vast profit that can be derived from a prolific field of this sort.

Whaling, as carried on by the Norwegian expedition, is unrivaled for sheer thrills and excitement. From the time the ships leave port for the whaling grounds until they return, perhaps months later, there is never a dull moment. The routine of sea life as experienced on merchant ships and passenger liners is unknown to the whaler. He never knows at one moment where he will be the next; whether the day will yield fruitless search and endless cruising, or be a succession of dashes, battles and prizes. In short, if one is looking for all the romantic side of sea life, plus rapid-fire action and excitement, whaling is the ideal profession. It entails tremendous energy and plenty of hard work, but it offers returns, both physical and financial, in proportion.

The whaling fleet consists of three "killer" ships and a mother ship. The mother ship is a lubberly craft that plods along and acts as tender to the small, fast killers. When these have succeeded in capturing a whale, it is towed alongside the mother ship and the latter attends to the routine work of dissecting it, extracting the oil, and other disagreeable but

From His Barrellike Lookout Station, Known as the Crow's Nest, the Whaler Keeps Watch over the Sea for Telltale Waterspouts

necessary work while the killer goes back to prowl over the seas in search for more whales. Likewise the mother ship acts as supply ship to the smaller boats; furnishes food, fuel and other necessities, and, in general, attends to the work of mothering the smaller ships and their crews. All the thrills of whaling come on the killer ships. They are small, sleek little boats, with an almost unbelievable supply of power. They are designed and built for speed and easy maneuvering, and in case of necessity, in pursuing a whale, they can almost literally be stood on end and turned in their own length. The most distinctive feature of these boats is the harpoon gun in the bow. This resembles, to quite a degree, the old-time Civil War cannon, to be found in every park and public square. It is mounted on a revolving base, and before the killer ship starts out on its errand, it is swung inward and loaded. Loading consists in inserting the harpoon in the muzzle of the gun. The harpoon is about four feet long and the rear end is attached to a long coil of rope. When the harpoon has been inserted, the explosive head is attached. This is a hollow iron device with a sharp point. A quantity of black powder is tamped into it and the head screwed onto the harpoon. The gun is then swung around again and all is ready for the appearance of the prey. A compressed-air hose is arranged near by, for reasons which will be apparent later.

With the gun thus loaded, the ship starts out to look for a whale. High atop the mast is a barrellike device which serves as a lookout tower. A sailor is stationed in this lookout with a powerful glass. To him falls the first duty of the trip—locating a whale. As the ship cruises around in waters where the whales are likely to be found, the lookout ceaselessly sweeps the horizon with his glasses. Suddenly the historic call "there she blows" comes from his station and instantly the

Taking in the Slack after Harpooning a Whale; the Photograph Shows a Thirty-Knot Speed Boat Used by New Zealand Whalers to Run Down the Fast-Swimming Prey at Sea

The New and the Old, a Whaling Speed Boat in the South Atlantic, and an Ancient American Whaling Bark, Now a Museum

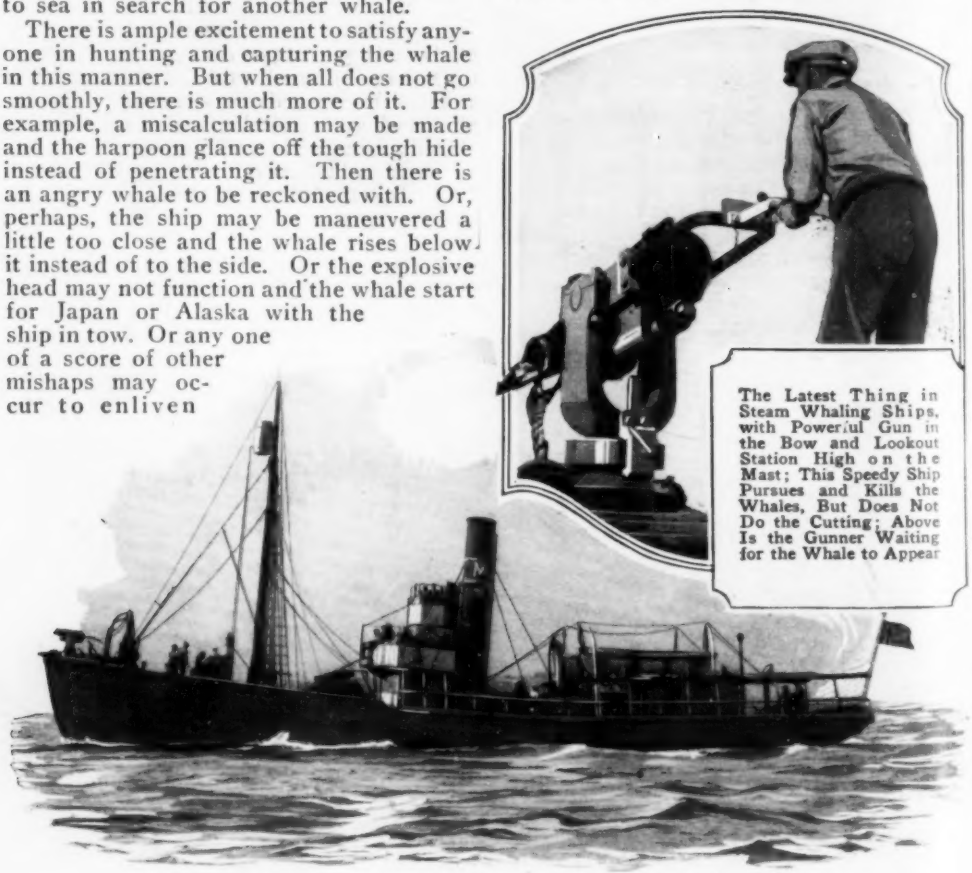
ship becomes a beehive of activity.

The course of the ship is directed toward the spot where the whale has been sighted. The captain or the first mate mans the gun, ready to fire when the quarry is close enough. Perhaps the chase goes on for miles, the killer maneuvering for an advantageous position as the whale dodges about. Finally, if all has gone well, the whale suddenly appears to blow directly ahead of the craft. As it rises to the surface the harpoon gun is discharged and the weapon is hurled into the gigantic animal, dragging the rope with it. There is a delay of a few moments while the whale dashes about in a frenzy and suddenly the explosive head of the harpoon goes off. Inevitably this ends

the battle. By no means is the fight to capture the prey over, however, even though the quarry has been killed. Here is where the compressed-air hose comes into play. A hole is quickly made in the body of the whale and the hose inserted. Air is pumped into the leathery hide until the whale resembles a small balloon. When sufficient air has been pumped in, the whale floats on the surface and can be handled. Otherwise it would sink and all the work be in vain.

Incidentally, this procedure of pumping up the whale has been the subject of much amusement to those who have seen it done. One imaginative newspaper cartoonist pictured hydrogen gas being pumped into the mammal instead of air and had the whale floating about in the sky, much to the amazement of passing dirigibles. With the whale captured and made buoyant, it is taken in tow and brought alongside the mother ship, where the work of extracting the hundreds of gallons of oil and the valuable whalebone is carried on. The killer ship then returns to sea in search for another whale.

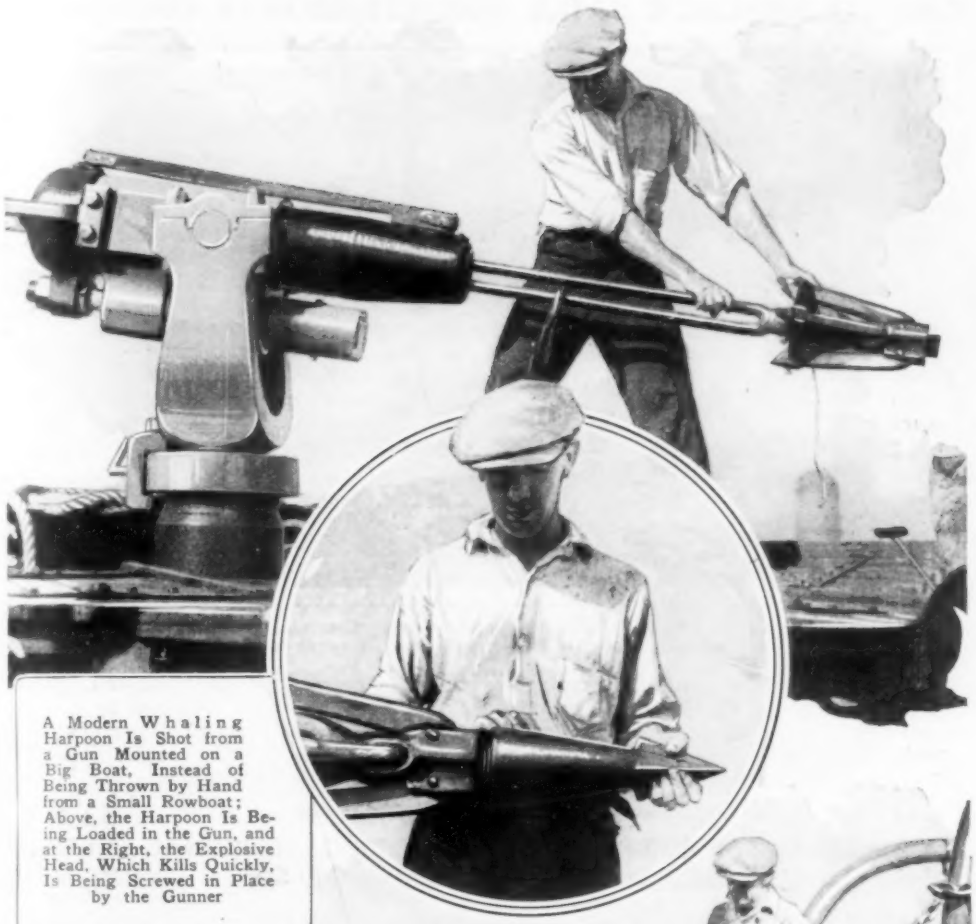
There is ample excitement to satisfy anyone in hunting and capturing the whale in this manner. But when all does not go smoothly, there is much more of it. For example, a miscalculation may be made and the harpoon glance off the tough hide instead of penetrating it. Then there is an angry whale to be reckoned with. Or, perhaps, the ship may be maneuvered a little too close and the whale rises below it instead of to the side. Or the explosive head may not function and the whale start for Japan or Alaska with the ship in tow. Or any one of a score of other mishaps may occur to enliven the chase. When it is realized that the Norwegian expedition captured practically 300 whales in a period of three months, an average of more than one a day for each killer, it can readily be seen that the Pacific waters off the Mexican and California coasts offer a splendid base of operations for the whalers.



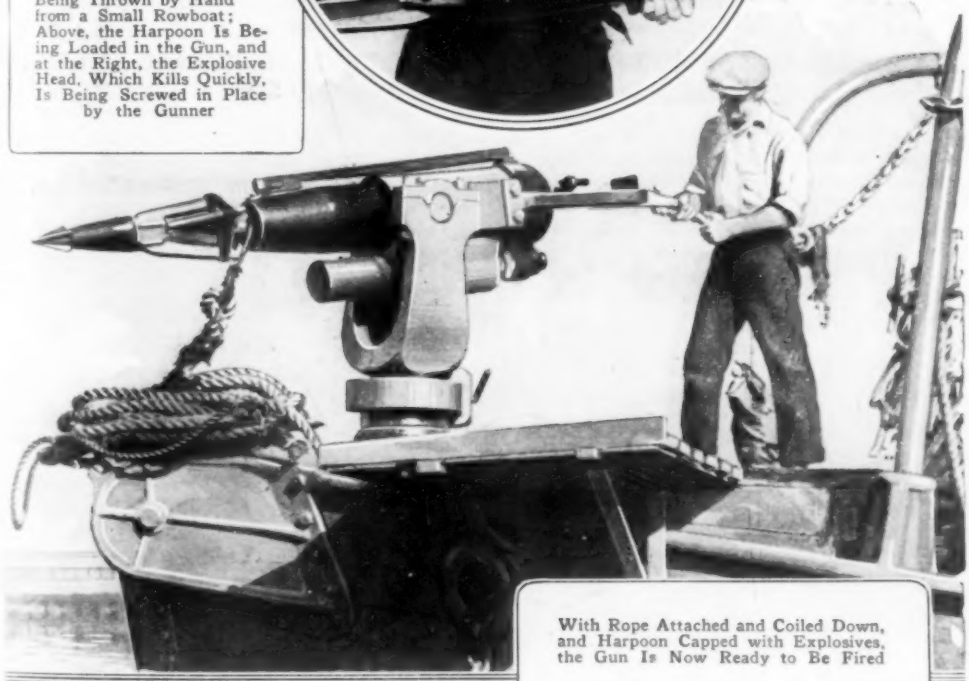
The Latest Thing in Steam Whaling Ships, with Powerful Gun in the Bow and Lookout Station High on the Mast; This Speedy Ship Pursues and Kills the Whales, But Does Not Do the Cutting; Above Is the Gunner Waiting for the Whale to Appear

WASHINGTON'S ENGLISH HOME RECONSTRUCTED HERE

Some of the stones and oak beams of Warwick priory, an old English country house, have been shipped to Richmond, Va., where it is planned to use them in reconstructing Sulgrave manor, the ancestral home of George Washington. Besides the beams and other parts, crates of leaded glass windows and as much of the carved interior of the old priory as could be removed, have also been imported. The builder plans to use the reconstructed manor as a residence, and then place it in the hands of the Virginia historical society as a museum.

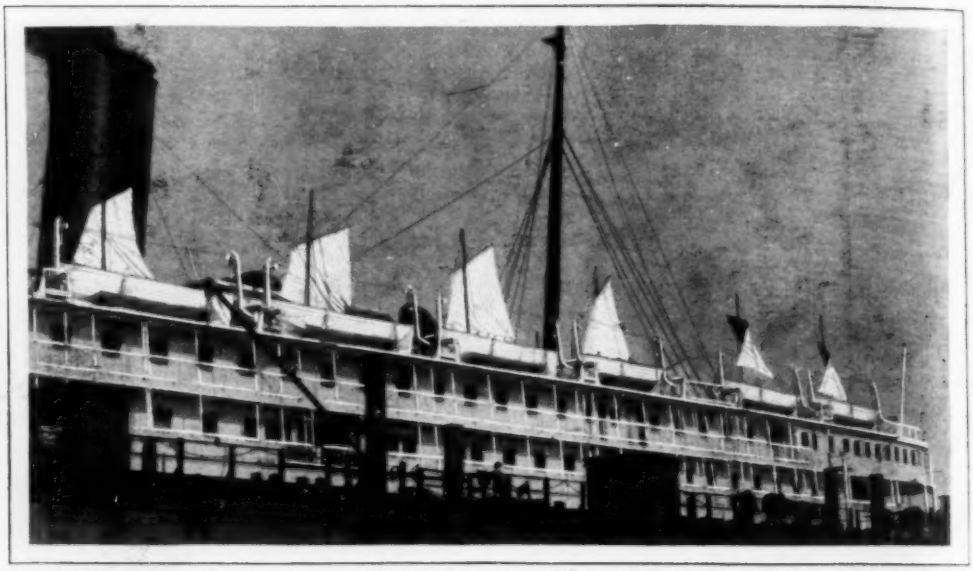


A Modern Whaling Harpoon Is Shot from a Gun Mounted on a Big Boat, Instead of Being Thrown by Hand from a Small Rowboat; Above, the Harpoon Is Being Loaded in the Gun, and at the Right, the Explosive Head, Which Kills Quickly, Is Being Screwed in Place by the Gunner



With Rope Attached and Coiled Down, and Harpoon Capped with Explosives, the Gun Is Now Ready to Be Fired

GAS TO REPLACE SAILS FOR LIFEBOATS ON LINERS



Where Wind Is Making Its Last Stand as an Ally to Navigation; Pacific Liner "Harvard" and Its Fleet of Sailing Lifeboats; Rigging Is Simple to Facilitate Handling in Emergencies

Sailing lifeboats on seagoing liners, the last bulwark of wind power in the passenger-carrying trade, is now being threatened by the gasoline motorboat. The British government requires all big English liners to carry a certain number of power boats, equipped with wireless, to tow the other lifeboats in case of shipwreck, so it may not be long before sails disappear forever from passenger ships.

VACUUM CLEANER FOR FURNACE SAVES TIME AND WORK

Operated on the same principle as the apparatus for cleaning rugs and floors, a vacuum outfit to rid the furnace of soot is carried from house to house on a small automobile truck and has extension suction pipes to make connections from the street. A huge bag collects the dirt.

Vacuum Furnace-Cleaner Outfit; Big Dust Bag at Rear with Section of Pipe Connection to House in Center

LENGTH OF NATIONAL AIR HELD TO SHOW SIZE OF COUNTRY

That there is a curious relation between the length of the national tunes and the size of the countries they honor, is the observation of an English musical expert. Only fourteen bars of music make up "God Save the King," yet the British empire is enormously vast. The old Russian national hymn contained but sixteen bars, whereas the national anthems of smaller countries are much longer, the Siamese song, for instance, having sixty-six bars and that of Uruguay, seventy bars. "Hail Columbia" contains twenty-eight bars and one of the longest hymns in the world is that of the tiny republic of San Marino. China, apparently is an exception, as no less than half a day is required to sing its national anthem.

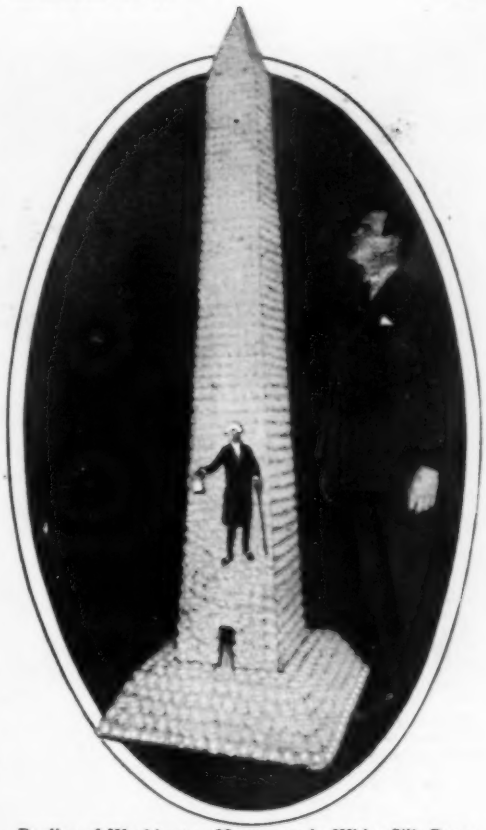
FRESH TIMBER CURED IN DAY BY VACUUM PROCESS

Fresh-cut lumber can be seasoned sufficiently for the carpenter's bench within a day or less by a high-vacuum process a Swedish engineer has discovered, according to reports from Stockholm. Green birch boards are made ready for constructing furniture in twenty hours, spruce and pine in thirty and oak in forty. The lumber thus cured is said to be free from cracks, warps and "blue" spots. Planks are placed on rollers and slid into air-tight chambers where they are first heated by steam from coils and then pumped dry by vacuum. The procedure is repeated according to the nature of the wood.

CAN OPENER WITH TURNING KEY CUTS TOPS OF ANY SHAPE

Adapted to angular as well as round tops, a can opener now on the market is intended to reduce the work and danger of cutting the tins. It has a sharp-edged and a ratchet wheel between which the rim of the can is clamped by means of a lever. By turning a broad key at the top, the ratchet easily turns the can while the opener is held stationary. This simplifies turning the corners on rectangular or square containers and makes it practically impossible for the hands to slip off. Safety is further assured by the smooth, flat edge left by the cutter.

Adjusting Opener to Can, and Lid Removed; Container Is Turned against Cutter with Key



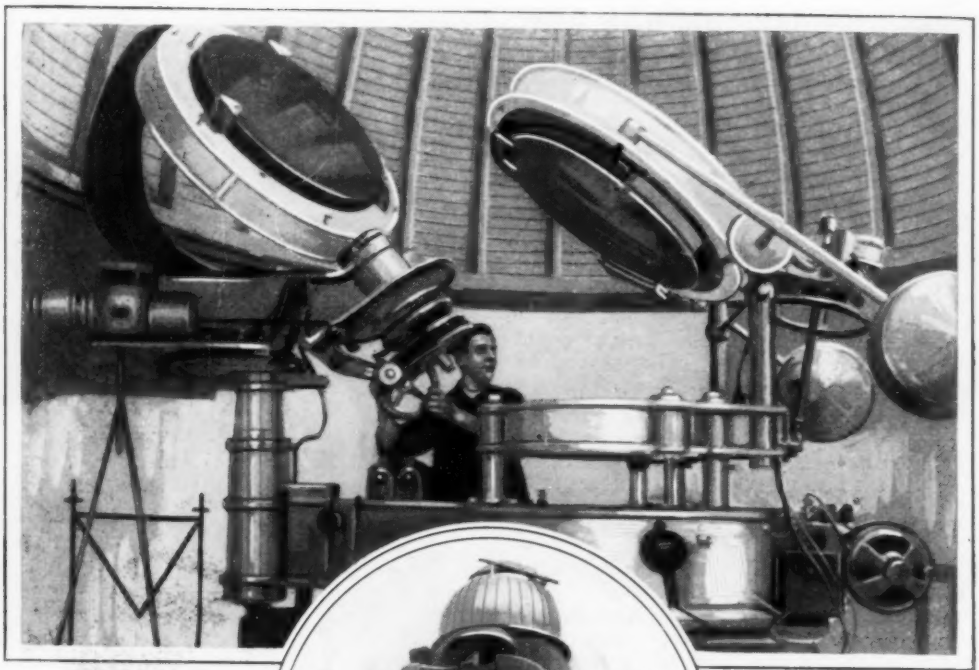
Replica of Washington Monument in White-Silk Roses

MODEL OF MONUMENT IN ROSES AS HONOR TO WASHINGTON

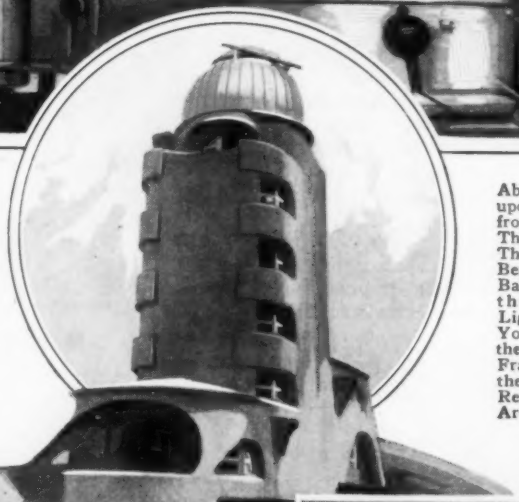
Containing 25,000 white-silk roses, a model of the Washington monument has been constructed by a New York man who proposes to have it autographed by persons attending patriotic gatherings and then presenting it to Mrs. Coolidge. On the inside and base of the model are seven large electric lights to illuminate the figure. Nearly three weeks were required to complete the work.

OPALS HARDENED BY FANNING TO SIMPLIFY CUTTING

Using an ordinary electric fan, an English gem expert has found a way to harden opals in a current of air so that they can be cut more easily, it is reported. The hardening is said to so toughen the stones that damage is less likely to occur when cutting and shaping them, and they retain their polish longer. This process also shortens the seasoning period that formerly was necessary to allow the stones to harden naturally.

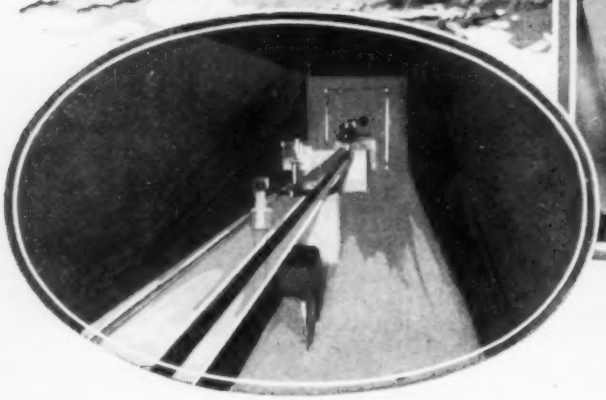


Views of the Tower Erected at Potsdam for Photographing Light from the Stars Especially for the Purpose of Further Investigating Einstein's Theory of Relativity; the Tower Itself, with Curious Porches and Windows, Is Like a Huge Telescope, But Only the Cupola Part and the Huge Mirrors Move; the Dome Opens and Turns as Usual

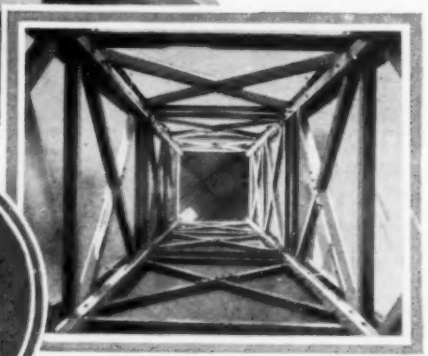


Above Are the Mirrors upon Which the Light from the Stars Falls; They Are So Adjusted That They Reflect the Beams Down to the Basement of the Tower through the Vertical Light Shaft up Which You Are Looking in the View Below; the Framework Is of Steel, the White Square Is a Reflector, and the Dark Area Part of the Inside of the Dome

Courtesy The Sphere



At Left Is the Tunnel Where Light, Reflected from Stars down the Vertical Shaft, Is Finally Photographed for Analysis; the Passage Is Fifty Feet Long and Is Insulated, to Prevent Temperature Variations, with Double Walls between Which a Man Can Walk



GOLD MINE OVER MILE DEEP COOLED BY ICE WATER

When workers in a gold mine 7,200 feet below the surface in South Africa became seriously affected by the high temperatures, efforts were made to cool the air by placing blocks of ice at various parts of the workings. It was found that this expedient lowered the temperature only one degree. The ice was then melted, the cold water being sprayed into the mine through the ventilating system. This met with far better results and an appreciable lowering of the temperature, which had varied from eighty-four to ninety degrees, followed. The problem was not wholly solved by this plan, however, as the moist air with the heat, was more likely to cause apoplexy, while the dry heat alone was productive of other diseases. The experiments therefore are being continued in order to correct these drawbacks.

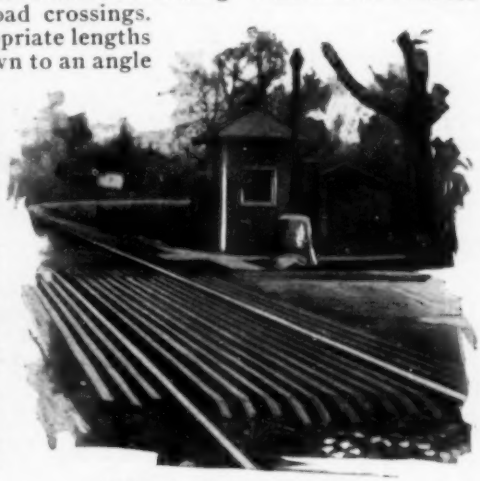
Recalling Past Glories of the Seas; Model of Five-Masted Full-Rigged Ship Exhibited at Motorboat Show in New York

MODEL OF FIVE-MASTED SHIP TOOK THREE YEARS TO BUILD

Visitors at a motorboat show in New York city caught a glimpse of the days of spars and canvas in a ten-foot model of a five-masted full-rigged ship. It was seven feet high, had a beam of thirteen inches and was ten inches deep in the hold. The hull was not fashioned from a solid block, but was planked and ribbed like a real boat. Sails were formed from vertical strips of tape sewed in the same way that actual sails are made. Sheaves of the blocks turned when the yards were braced and nearly every other detail was true to life and carefully constructed to scale. The amateur who built the model spent about three years in making it.

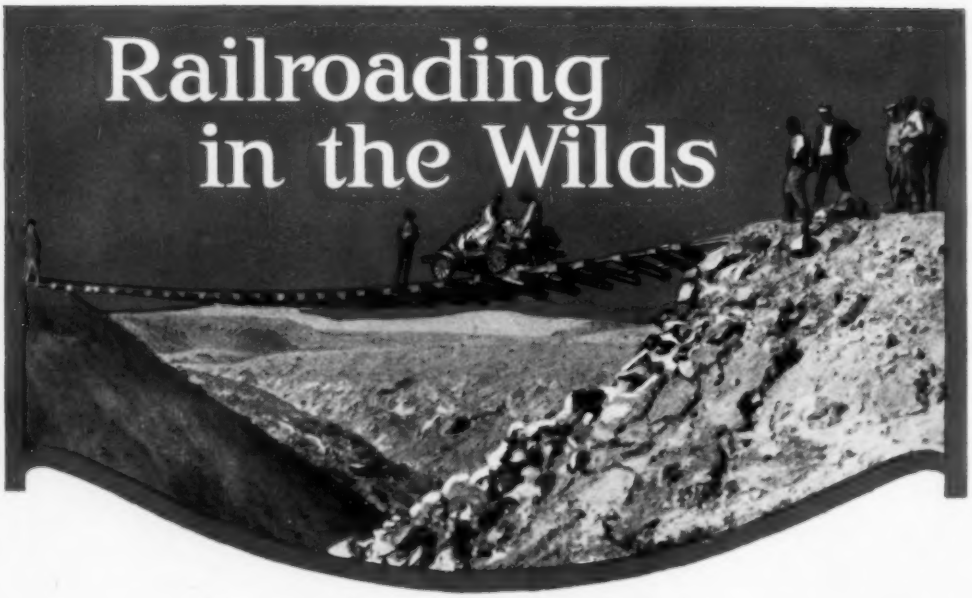
OLD RAILS AS CROSSING PLANKS REDUCE REPAIRS AND BUMPS

Instead of discarding its steel rails after they have served their time on the roadbeds, a middle western railroad is utilizing some of them for road crossings. They are cut to appropriate lengths and the ends bent down to an angle of about forty-five degrees. They are then placed on the crossing with the curved ends to the ground and are spiked to timbers. Spaces between the rails are filled with a mixture of tar and finely crushed rock. A smooth surface is the result, loose boards that may fly up and damage autos and cause accidents are avoided and repairs reduced.



Old Rails Installed at Crossing

Railroading in the Wilds



Thrills and Adventures with Big Game on the Night Mail Trains in the Tropics

By HAROLD T. WILKINS

IT is a cold night in the wild bush country of India where the great transcontinental railroad runs through heavy jungle. In the cab of the locomotive, the engineer is trying to make up time to catch the mail boat due to leave for Europe on the following day from a port 800 miles down the line.

The native fireman reaches for a shovel, when he sees, on the roof of the car coupled to the engine tender, two eyes and the form of a Bengal tiger. The fireman is paralyzed with fear, but the engineer senses the danger and looks around. Quick action is imperative, and as he slows the train down to a stop, he jerks open the firebox door, and a sudden blaze of light illuminates the dim interior of the cab. The whistle screams, and the astonished tiger leaps from the car and speeds across the track into the black night of the jungle. Probably, as the night mail stopped to take in water at a wayside tank near the bush country, the animal had bounded on the car in search of food.

Tigers, however, though formidable opponents to encounter at night on the footplate of a racing express, are not the most dreaded enemy of the engineer on a tropical road. On some lines wood fuel is used. One night, the fireman of a mail train, running from Bombay to Madras, was heaving logs into the furnace, when a cobra uncoiled itself from a billet of wood and reared up into a hooded crest. The reptile had been aroused from its torpor, due to the cold night air of the tropics, by the warmth of the fire radiated from the open door of the firebox.

High up on the "roof of the world"—the Himalayas—a picturesque railroad, often doubling back on itself, climbs to the cool hill stations from the burning plains of northern India. As soon as his engine is in the dense jungle, the engineer stops and lights a flare on the roof of his cab. He does this to scare away big game from the railroad track.

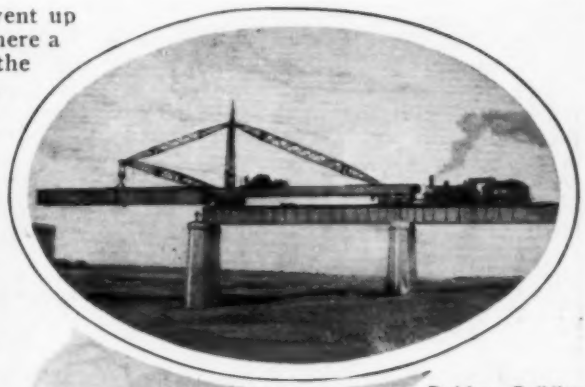
One Indian train was wrecked by a collision with insects. It ran into a crowd of millions of locusts. The engineer applied his brakes, but the insects had so greased the rails that the train crashed into a dead end. On the French military railroads in Algeria and Morocco, these locusts, at certain times of the year, darken the sky and cover the ground to a depth of three inches. Only very slowly can the locomotive grind its way through the mass.

On a railroad in Rajputana, northern India, the train to Delhi was crossing a sandy desert, when the brakes ground the

wheels. Everybody got out and went up the line to the head of the train, where a sacred cow or white zebu, lost in the desert, had strayed onto the line. The oil-stained, turbaned Hindu engineer bent down and gently pulled the cow's horns and tail to persuade her to rise. Not for untold wealth will the Hindu engineer run down a holy cow.

Near where the Victoria falls—a wall of waters 400 feet high—foam over the mile-wide gorge of the Zambesi river, in South Africa, is a splendid big-game reservation. Along this section of the Rhodesian railway giraffes are frequently seen from the trains, and elephants and zebras are not uncommon. The line runs through a wild country of jungle and bush, in which the wild pig, the eland, the wildebeest, the dangerous sable antelope, deer, and, last but not least, man-eating lions abound. One day, not long ago, a passenger train, at a turn of the track, ran into and was derailed by a herd of thirty-six wild elephants.

Lions swarm in Rhodesia. On dark moonless nights they swoop down on some native cattle stockade. All of them stand outside the six-foot palings and roar in unison. The women shriek in fear, the men blow trumpets and yell, and the cattle stampede. This explains the alarm of a South African station-master who recently sent two frantic telegrams down the line in quick succession from an upcountry depot on the lonely veldt. "Please send further police protection. Men very brave, but less so when lions begin roaring." Then, "Please let 10:00 a.m. run up the platform, disregarding signals. Signalman up post. Lion at bottom."



Bridge Building in India, Where a Derrick Flat Car Handles Complete Girders; Center, Building a Temporary Wooden Pile Bridge, and, Bottom, Unloading a Locomotive from a Railway Car in India

A loud whistle announced the arrival of the passenger train from Bulawayo. Looking cautiously out of an aperture on the side of the cab, the engineer saw a full-grown lion stalking an unfortunate man, clinging to the top of a signal post. The terrified station officials had barricaded themselves in the railroad buildings. The engineer gave a little turn to a switch in the cab, and such a roaring, hissing cloud of steam burst from the engine's valves and cylinders, accompanied by a series of blasts on the whistle, that the lion fled. A much worse fate met an ostrich which

one day charged an express train in South Africa. The kick of this big bird is worse than that of a mule, and it can even fatally injure a man. The ostrich got on the track and ran down the line between the rails, head on toward a South African mail train making up for lost time on the way to Cape Town. It disregarded the warning whistle, charged the locomotive, hit the cowcatcher and was killed.

The Field museum of Chicago recently obtained from Lieut. Col. J. H. Patterson, an English civil engineer, the skins of two of the most famous lions in the world, who, between them, tied up construction on the Uganda railroad for three weeks and interfered with it seriously for several months, before both were finally killed by Patterson. During that time the two lions killed twenty-eight Indian laborers on the road, in addition to several score African natives in villages of the neighborhood.

The depredations of this pair are without a parallel in the stories of railroad building in the wilds. Appearing at Tsavo, 132 miles from the coast, the pair for nine months spread terror among the railroad builders, most of them coolies imported from India. They invaded the tents at night, despite strong fences of almost impassable thorn bushes, and seized and carried off the sleeping men almost at will. Two or three times a week, for months, the scattered camps were visited, first here and then there, until finally the entire working force was driven to sleeping in trees, on platforms atop water tanks, or on special scaffolding erected for the purpose. The reign of terror got so bad in December, 1898, that practically all the workmen seized a train and left for the coast, not returning until both lions had been stalked and killed.

Starting with two Hindus, seized in their tent one night, the pair began a regular round of the camps. Armed European officials camped in trees and on specially built platforms night after night, but with uncanny precision the lions for months picked out one of the few unguarded spots and made their raids.

In the early days of the raids, the workmen were scattered in tent camps along eight miles of the right of way, some grading the roadbed, others laying ties, and the rear guard placing the rails, so the lion pair had an extended field in which to work. They were not always successful in their raids. On one occasion, a lion broke into a tent occupied by a Greek contractor and by mistake seized and carried off the mattress on which the man was lying, but left the occupant of the tent quite unharmed. At another time, one of the animals jumped on top of a big tent in which fourteen coolies were sleeping, broke through the canvas, and landed on one of the sleepers, clawing his shoulder badly, but instead of seizing one of the

Big Bull Elephant, Leader of a Herd of Thirty-Five, Which Tried to Cross an African Railway Just as the Train Arrived; the Locomotive Was Derailed and Badly Wrecked, Too

Construction Work on a New Tunnel of the Southern Pacific in the Sierra Nevada Mountains, Where Snow and Intense Cold Furnished Natural Obstacles to the Work

fourteen humans, grabbed a bag of rice in its mouth and trotted off with it.

As the attacks continued, the lions grew bolder and bolder, until finally nothing flurried or excited them and they took time to pick their victims with care. Shouts, shots and waving firebrands failed to stop them then. During the early months of the reign of terror, while the railhead camp with more than 3,000 men remained at Tsavo, the workmen accepted the attacks two or three times a night philosophically, apparently feeling that with so many victims to choose from, they had a sporting chance of being overlooked. When the railhead finally moved on, leaving only a few hundred men to build a bridge over the Tsavo river and do the final ballasting of the road, the situation became more serious, eventually resulting in the stampede of the workers on a confiscated train and total cessation of road building.

The men were concentrated in a few small camps strongly guarded by thick and high thorn fences, with bright fires and armed guards on watch inside the inclosures, but despite all these precautions the pair of man-eaters succeeded two or three times a week in breaking through or jumping over the obstructions, selecting a victim and making off with him under the eyes of the frightened natives.

As the lions grew bolder they took to stalking men along the right of way in broad daylight. One coolie trackwalker saw one of the beasts coming, and succeeded in climbing a tree, where he remained under guard of the beast until an official caught sight of him from a passing train and stopped to effect a rescue. The same afternoon one or the other of the lions was seen in three different places, one, just at dusk, stalking the doctor of the camp hospital.

Col. Patterson and the doctor decided to try stalking the lion by spending the night in a freight car parked near a recently deserted camp. The car had a door built in two parts, and they closed the lower half, leaving the top section open so they could watch and shoot if the lion appeared. The plan was nearly fatal, for instead of their stalking the lion, it stalked them and was in midspring for the open door when both saw it and fired, failing to wound, but causing it to swerve and make off.

A trap built in two parts was tried, the inner cage, separated from the outer by railroad rails, being baited with a number of workmen who slept there nightly. One of the lions actually invaded the trap and was caught, but the terrified workmen, firing through the bars, only succeeded in shooting off part of the door, allowing the animal to escape.

Col. Patterson finally succeeded in shooting one, from a perch in a tree, and

not long after bagged the other in the same way.

Considerable damage is caused to railroads near the equator in central Africa and South America, when troops of monkeys swoop down from trees over trains passing through forests to the coast and plunder cars loaded with fruit and nuts.

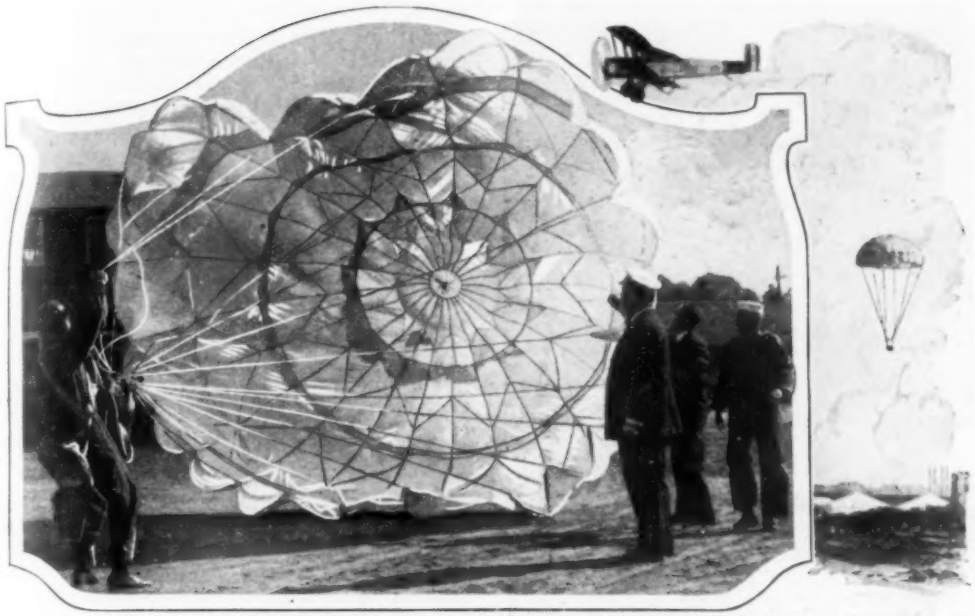
In another out-of-the-way part of the world, the vast forests of the Malay peninsula shelter roaming herds of wild elephants and other fierce and powerful animals, providing plenty of excitement and thrills in the life of the railroad men. A passenger train collided with a wild elephant in the Malay jungle and the locomotive was thrown from the rails. A few months ago, a herd of rogue elephants attacked a lonely railroad depot in the Federated Malay states, tearing up the rails with their tusks. A month later, at night, the wild elephants broke into a passenger depot, smashed the walls and damaged office fittings and furniture. Then a big tiger, bound for Singapore and the New York zoo, escaped from its cage on the railroad, and calmly walked into the compound of a hotel. People who were playing billiards made a quick exit, and the tiger sought refuge under a table where it was killed by a sportsman.

The volcanic island of Java holds some thrills and shocks for railroadmen working its 600 miles of lines. Here no trains run at night, because the Dutch, who control the island, cannot or will not trust the native engineers and operators. One recent summer morning, a train, in crossing a high bridge, crashed into a herd of wild water buffaloes — fierce and powerful beasts. The locomotive toppled over into the river, carrying away portions of the steel girders in its fall, and killing twenty-five people.

An epidemic of accidents at this place followed. Three weeks later, near the same bridge, a wild buffalo charged into a passenger train, derailed the locomotive, killed the engineer and injured the fireman. Another passenger train, a few days later, was pulled up only just in time to avoid smashing into four of the animals.

Monkeys, which have often figured in incidents on tropical railroads, are trapped and caught in the Philippines in a curious way. The animal will swing down by its tail from a tree onto a moving freight car loaded with coconuts. The brakeman takes advantage of its greed and indolence by cutting a small opening in the shell of a coconut just large enough to admit the monkey's long, thin hand. He puts this shell in the car, and when the plundering monkey comes on the scene, in goes its paw to clutch the delicate meat. But its hand is now wider than when it entered the nut, and finding it will not come out, the animal chatters and scolds, but never thinks of loosening its clutch on the coconut meat, and so is easily captured.

Building the First Railroad in the South Pacific, a Mine Line Running to Laloki Copper Mines, Papua, British New Guinea; Owing to the Climate, Native Labor Had to Be Trained



Inspecting New Parachute at Naval Station; Although Cords Are Twisted, It Opens Readily and Little Skill Is Required in Folding It; at Right, Demonstration Descent from Low Altitude

NEW PARACHUTE WITH VALVES OPENS IN SHORT FALLS

With a series of valves placed along its entire wall to facilitate opening, an improved type of parachute tested by the navy, promises to decrease the peril of descents, as it is said to permit successful use in falls of 100 feet and less. No skill is needed in folding and packing it, reports state, and no danger to the airman results if the cords should become twisted at the time of the drop.

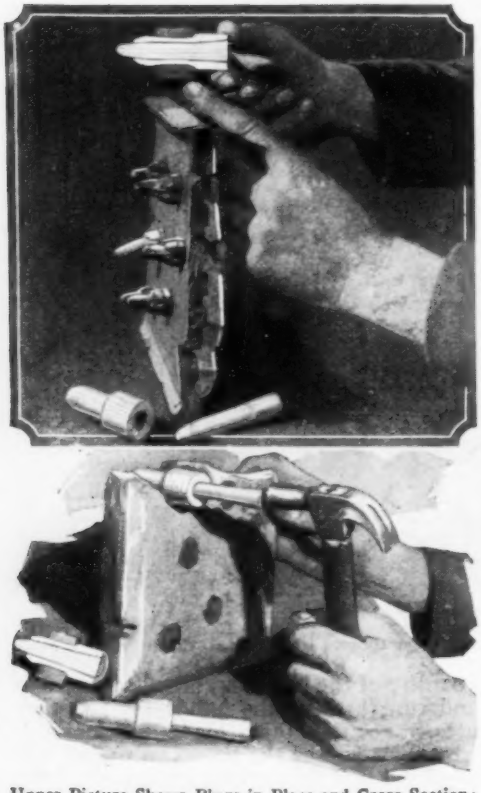
TEA "TICKLED" IN CHINA TO IMPROVE ITS FLAVOR

"Tickling" tea as practiced by the Chinese, not only brings out the flavor but prevents wasting the leaf, according to an English expert. It appears that tea contains an active poison in the form of an essential oil, and so the Chinese do not use the tea until they are sure it is at least a year old. When ready for consumption, a quantity of the leaves is spread upon paper and run through the hands for ten minutes, or so; then put aside in the sun. This treatment causes the leaves to uncurl and admit air and thus create an outlet for the poisonous gases, while later the heat of the sun recurls them in fifteen minutes.

Using Loud Speaker Attached to Telephone Receiver Leaves Both Hands Free for Work

LOUD SPEAKER FOR TELEPHONE ADDS TO INSTRUMENT'S USE

By attaching a special loud speaker to the telephone receiver, conversations can be heard across a fair-sized room, it is said, and the person listening has both hands free for writing or other work. No alterations in the telephone are necessary. The speaker is fixed to the phone with a setscrew and the receiver hook is controlled by a lever which can be locked so as to hold it raised while the conversation is going on. Should the conversation be of a confidential nature, the receiver can be used in the regular way after the speaker has been removed.



Upper Picture Shows Plugs in Place and Cross Section; Below, Driving and Tops Sawed Off

EXPANSION PLUG FOR BUILDING AIDS IN FASTENING TRIM

Wooden plugs that expand and hold fast when they are driven into tile, brick, concrete, metal lath and similar materials, have been devised by a western inventor, to afford a suitable base for fastening chair rails, molding and other trimmings to walls. It is only necessary to bore holes where the plugs are wanted and drive them in, saving the labor of removing plaster or other surfacing and attaching wooden strips. The fasteners are of poplar, bind firmly to the sides of the hole and when the end is sawed off, a convenient space for nailing is left.

PLAN AUTO-AND-TRAIN TUNNEL THIRTY-TWO MILES LONG

Preliminary surveys for the construction of a tunnel thirty-two miles long under the Cascade mountains have been undertaken by the state of Washington. The bore is to be built for both trains and automobiles and will carry water from the western to the eastern slope of the Rocky mountains for the purposes of irrigation. The project was conceived by the late H. M. Chittenden, who was also the originator of the idea of linking Lake Union and Lake Washington with Puget sound by canals. When completed, the tunnel will be more than twice as long as the Simplon tunnel through the Alps.

TAILLESS SPECIES OF SHEEP SOUGHT BY BREEDER

By crossing domestic with a variety of Siberian sheep, Prof. J. W. Wilson, director of the South Dakota agricultural experiment station, hopes to produce a tailless species. After several years of careful selection and breeding, a ram was born without a tail, and of twenty-one of its offspring, eighteen are practically tailless. Prof. Wilson says that the tails may come back in the next generation and is unwilling to call his experiment complete, but believes that the production of a permanent tailless species is possible.

RADIO SET ON BICYCLE PERMITS RIDING TO MUSIC

While riding his bicycle, an eastern enthusiast enjoys musical programs from a radio set which he has attached to the handlebars and front part of the frame. The loop, batteries and other parts are securely connected, to prevent damage from vibration, and do not interfere with the rider who can tune the set while in motion.

Bicycle Radio Can Be Tuned While Riding

How Ammunition is Tested

By CAPT. EDWARD C. CROSSMAN

THE flintlock with which two of our wars were fought was as likely to miss as to hit a man at a hundred yards. Since then the improvement in arms and ammunition has been so great that in the last government test at the Aberdeen proving ground, ten consecutive shots were put into a space hardly larger than a tea cup at a range of 328 yards. Taper-tail bullets, which add practically a mile to the extreme range of the missile, were used. They proved not only to add enormously to the efficiency of the small arms, but to give higher accuracy as well.

No rifleman, even if equipped with the finest of rifles and a telescope sight, could aim and fire the rifle with so little error as this, for hundreds of shots. Machinery has to be called in, and it must be apparatus accurate to one-thousandth of an inch or less to afford such results.

The old method of testing ammunition was to clamp the rifle in what is known as a "machine rest," which was a heavy steel bed resting on a concrete base, with clamps to hold the rifle at the butt, the frame and the muzzle to the heavy sliding base. It was not a satisfactory method because clamping down the service rifle of ordinary weight would sometimes distort the barrel, and many a test was lost by some company because the rifle used was improperly clamped in the rest.

In these days a special, heavy barrel is used, twenty-four inches long and one and one-quarter inches in diameter. Two heavy steel rings are placed on the barrel so that, regardless of how it is revolved, it will not change the line of the bore.

A V-shaped groove is milled in a heavy block of steel, its sides cut accurately and parallel, and permitting the two rings around the heavy barrel to fit down into this cut. Fine screws move the heavy V-block up and down or sideways.

The importance of absolute uniformity is shown by the fact that an error of one-thousandth inch at the muzzle would move the next shot two inches at 1,000 yards, and the comparatively small error of one-hundredth inch would move the bullet twenty inches.

Until improvements were made this year, the barrel with a short bit of stock attached, was merely laid in this V-cut in the steel block, a cartridge loaded into the breech and then the trigger was carefully squeezed to avoid moving the barrel. It slid back under the recoil, and the firer caught it with the palm of his left hand to prevent its sliding clear out of the V-cut. Now a clamp holds the barrel in the V-cut.

The heavy barrel, with its freedom from "whip," or bending in firing, and the accurate V-cut in the steel base make possible the delivery of 100 shots with no inaccuracy that can be measured. If the ammunition could be made accurately enough, and the wind would refrain from blowing, this improved Mann rest could almost put one bullet on top of another at a

Testing Small-Arms Ammunition at Government Station, near Daytona, Fla.; Bullets Are Shot at Screen Target Placed Fixed Distance from Gun for Measuring Angles of Departure

half mile. The speed of the bullet is tested by an instrument called the chronograph, which merely balances the distance a weight falls against the time taken by the bullet to travel about 150 feet. The bullet cuts a wire as it leaves the muzzle, breaking an electric circuit passing through an electromagnet and permitting a heavy weight to fall. When the bullet reaches the other end of the testing distance, it strikes and drives back a loose steel plate, breaking another electric circuit passing through a second magnet. This second magnet controls a spring-actuated trigger and knife. The knife blade, thus released, flies out and makes a mark in the weight released by the first electric circuit. This nick or mark, cut into the lampblacked weight of soft lead or brass, shows how far the weight fell before the knife struck it, and thus how far it fell while the bullet was passing over the measured distance. The rate of fall of a heavy object is easily ascertained from tables on hand, and it is thus converted into fractions of a second.

The internal pressure developed by the cartridge in the barrel of the gun is measured by drilling a hole in the barrel at a point about opposite the "neck," or mouth, of the cartridge. A little shallow copper cup is pressed down into this hole until it reaches the cartridge, then a steel piston just fitting the hole is pushed down until it reaches the copper cup or gas check. Above this is placed a short piece of copper rod, measured exactly as to its length.

An "anvil" or block to hold the copper is screwed down against the copper rod, while a housing attached to the barrel holds the steel anvil. When the gun is fired, the gas cuts a little round section out of the cartridge case and then drives the steel piston violently outward. This, in turn, compresses the section of copper rod against the steel block above it, shortening the copper perceptibly. As the amount of force to shorten the copper rod is known by test of the lot in a static machine, a simple measurement of the shortening produced by the shot, gives the internal or chamber pressure.

With very low-pressure arms, such as shotguns and .22 rifles, the compressed material is lead instead of copper.

Recoil is measured by firing the cartridge in a heavy gun swung by wires, and measuring the distance the thrust moves the gun backward.

Shotguns and shotgun ammunition require a different method of testing. The performance of a shotgun is judged by the "pattern" or distribution of the pellets on a large piece of paper or whitewashed steel plate, and on the penetration given by the pellets. The standard distance for pattern testing is forty yards, and the standard circle is thirty inches in diameter. A full-choke gun should throw seventy per cent or more of its charge into this thirty-inch circle.

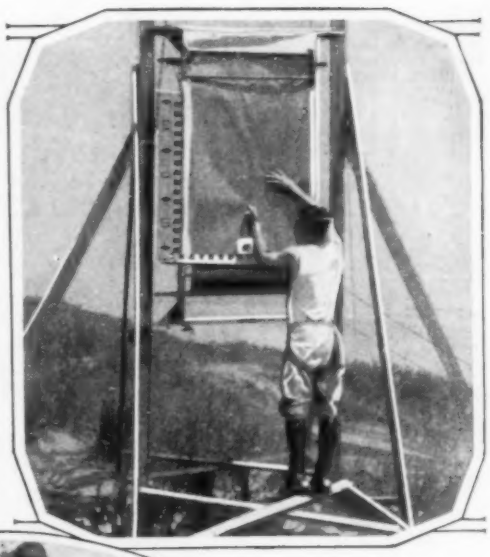
A third test of shotgun performance is of more modern type and is more difficult; this is to determine in how long a column the shot travels from muzzle to the mark. Some guns and some loads tend to "string" their shot in a long column. The final "pattern" does not show this stringing because all of the pellets eventually arrive at the paper, but with a fast-flying duck crossing the column, only a few of the shot would strike it because of the number lagging behind. Tests showed that with some loads and powders, the shot

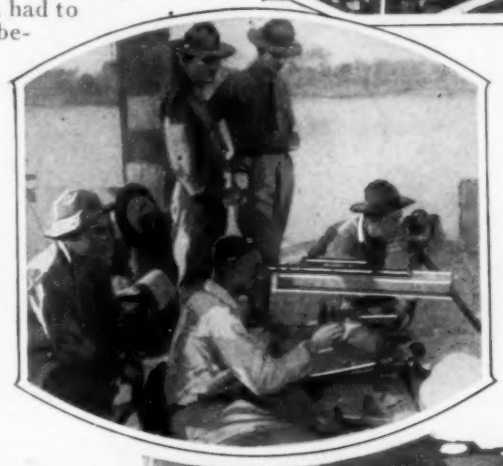
column was as long as fifty feet when the leading pellets had reached a point sixty yards from the gun.

Modern developments in progressive-burning shotgun powder tend to reduce this stringing, and thus create a much more deadly load, although the pattern board and the penetration rack showed both sorts of powder acting about the same. Neither board nor rack could show the shot stringing, which is told by scientific apparatus.

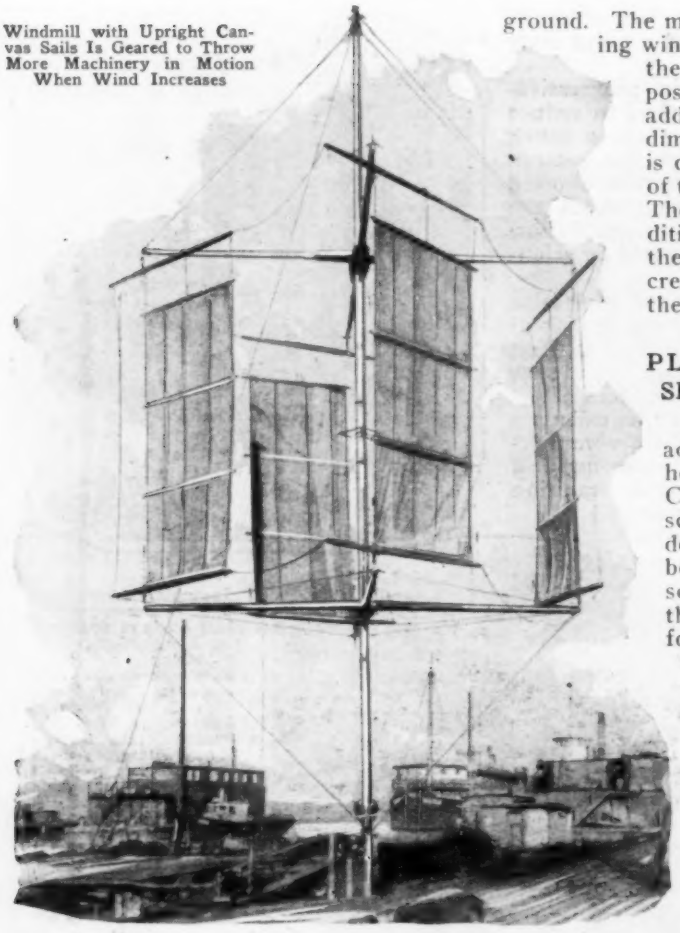
One method of detecting stringing is to fire the gun at a rapidly revolving disk of large size. Obviously the pellets lagging behind strike the disk at a different spot from the leading pellets. The speed of the disk being known, it is easy to calculate how far behind the later pellets were traveling. Incidentally, the whirling-disk scheme was used for testing ammunition intended for airplane machine-gun use, in which the gun had to fire in the intervals between the whirling propeller blades.

Obviously, if the discharge was late, the bullet might strike the blade of the propeller. Ammunition for this purpose was fired at a revolving disk and if the shots in the "burst" occupied more than a certain sector of the disk, the lot of ammunition was thrown out as being dangerous.





Inspecting Screen after Shot, to Determine Bullet's Angle of Departure on Long Flight, and Preparing the Mann Rest with Special Telescope for Trial Shots; This Is an Improved Support, to Hold the Special Rifle Barrel When Firing, and Is So Accurately Adjusted That if the Ammunition Were Perfect and the Wind Didn't Blow, Bullets Could Be Put on Top of One Another at Half a Mile; Below, Measuring the Groups to Compute Final Results in Ammunition Tests



Windmill with Upright Canvas Sails Is Geared to Throw More Machinery in Motion When Wind Increases

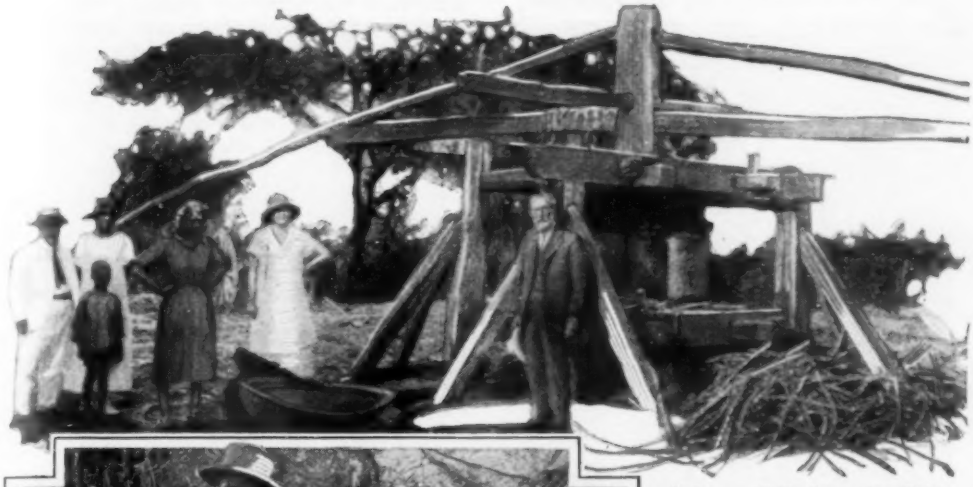
WINDMILL WITH CANVAS SAILS DEVELOPS GREATER POWER

Said to be capable of developing from five to twenty horsepower, a windmill rigged by a western inventor has four upright canvas sails, each seven by fifteen feet, instead of the customary rosette-type of wheel. The sails are supported from spreader arms fastened to a center pole, and are about fifty feet from the ground. Theoretically, the canvas propellers are supposed to convert seven-eighths of the velocity of the wind into power, but actually they pull only during three-fourths of each revolution. The center shaft is mounted on a universal joint to avoid absolute rigidity and to give a certain amount of flexibility to the bearings. An advantage claimed for this arrangement is that a comparatively simple superstructure is required, all the power-converting machinery being on the ground. The mill is regulated to increasing winds, not by taking it out of the line of the breeze, as is possible with a wheel, but by adding to the load instead of diminishing the power. This is done by means of a series of trips actuated by the wind. They automatically add additional pumps or motors as the velocity of the wind increases, and release them as the wind subsides.

PLANTS' HEARTBEATS SHOWN BY SCIENTIST

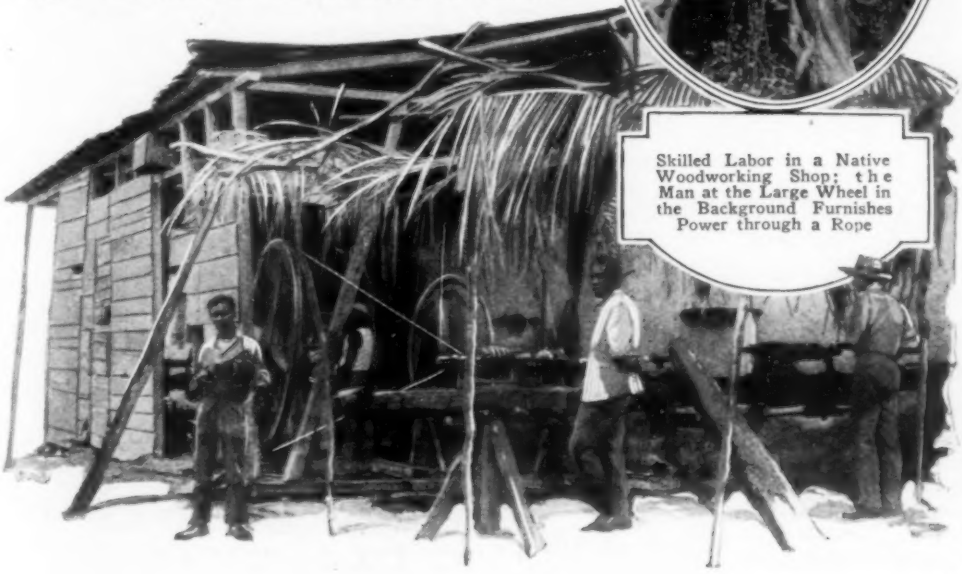
With the aid of carefully adjusted instruments which he has invented, Sir Jagadis Chandra Bose, an Indian scientist is reported to have demonstrated the "heartbeats" of plants and to have solved one of the questions that has puzzled scholars for many years, why sap flows upward. The "heart" was located by means of an electric probe in circuit with a sensitive galvanometer. The probe was introduced step by step across the stem of the plant until it came in contact with the pulsating layer. This produced an electric response which was recorded. The scientist is said to have discovered that each active cell, while expanding, absorbs water from below and expels it upward during contraction. He likens the heart of a plant to that of the elongated organ in some of the lower animals, such as the earthworm, and declares that the life mechanism of plants is similar in many respects to that of living creatures. By means of an amplifier the plant's heartbeat was measured and found to be less than a millionth of an inch. A specimen's reaction to chloroform was demonstrated to an audience by causing the apparatus to throw a beam of light on a screen. The drug at first greatly stimulated the plant, but this result was followed by a death spasm, shown by the rapid fluctuation of the light beam until it finally came to rest. According to the investigator's experiments, inorganic substances also exhibit fatigue similar to that of muscles and this is removed by a period of rest.

Where Men Do the Work of Machines



Industry Still Lags in Haiti; Above Is a Native Cane Mill, Operated by Ox Power

Native Tinsmiths Work in the Open and Use Discarded Oilcans for Material; These Men Are Making Cups, Graters and Funnels; at the Right Is a Native Carpenter, Using His Modern Saw Backward



Skilled Labor in a Native Woodworking Shop; the Man at the Large Wheel in the Background Furnishes Power through a Rope

SAFETY LIGHTS IN PAVEMENT PROTECT PEDESTRIANS

Flat-Faced Pavement Lights, to Mark Safety Zone at State and Madison Streets, Chicago

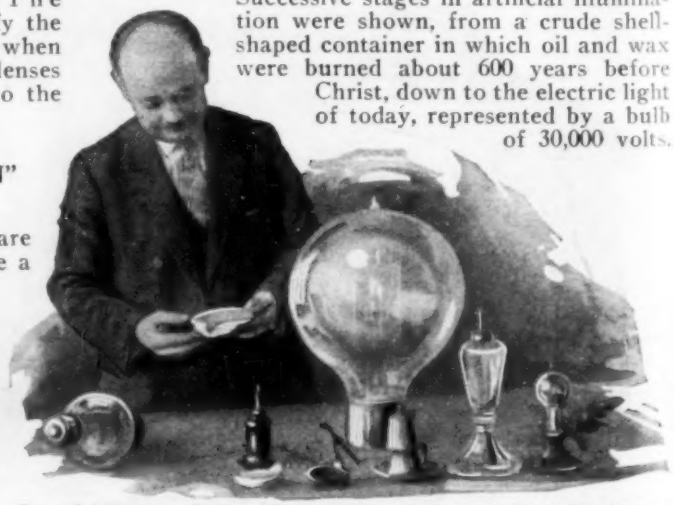
So that street safety zones can be plainly distinguished at night, electric lights with flat surfaces, flush with the top of the pavement, have been installed at a busy intersection in Chicago. The lamps also help to identify the area in the daytime, even when not lighted, as the glass lenses form a distinct contrast to the dark paving.

CURIOUS "ONE-MAN" TRADES

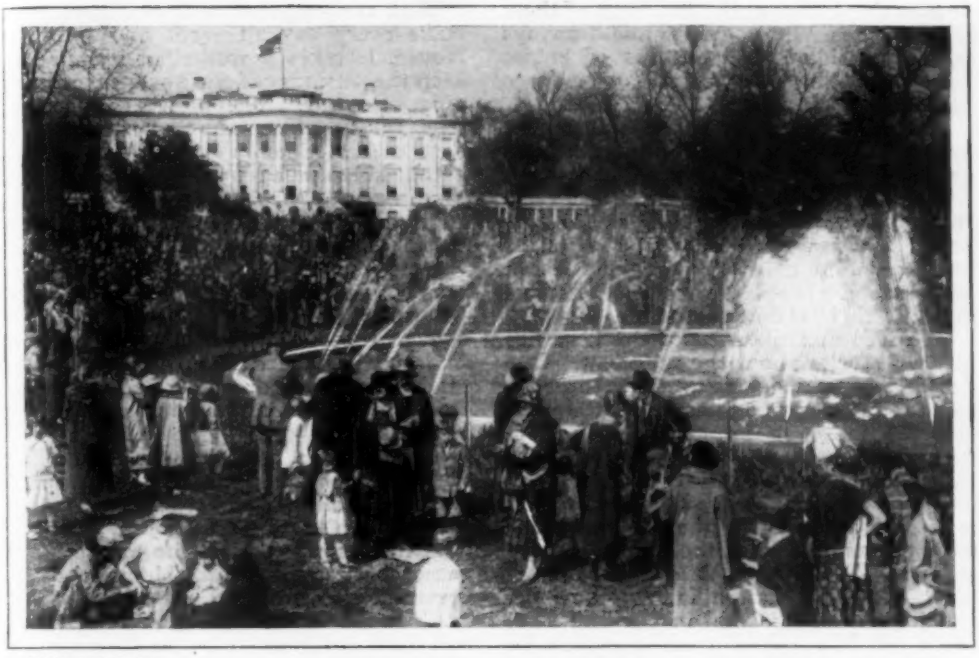
Nearly all professions are overcrowded but there are a few occupations with only one follower, so far as is known. An Englishman, in the census returns, stated that he was a walrus-moustache collector. The hairs which are exceedingly thick, are used for making toothpicks. London has only one moss gatherer. He pushes a wheelbarrow twice a week to a place several miles from the city where he collects fresh moss and sells it for decorative purposes. An American woman makes a business of giving suitable names to babies. Only one man at a time in the subtreasury at Philadelphia is said to know how to stack bags of coin so they will form a solid wall and not fall down with possible injury to persons near by. When he retires, he teaches the secret to someone else. Not long ago, London's list of tradesmen included a professional "champagne disgorger." His task was to remove sediment without losing any of the wine. The bottles were placed upside down in a rack to permit solid material to collect on the corks which were then extracted in such a manner that the sediment was thrown out but none of the champagne spilled. There is but one woman veterinary surgeon in England and, until a few years ago, only one Englishman pursued the trade of making wicker armchairs for dolls. Another little-known occupation is that of breeding toads to sell to gardeners for destroying insect pests. For thirty-six years, a man was employed by a British factory just to strike matches to test them, and London has a man who sells asses' milk which is highly prized by some for its nourishing qualities.

MAN'S PROGRESS IN LIGHTING SEEN IN LAMP EXHIBIT

Some twenty-five centuries of human progress were visualized at a glance in an exhibit of lamps displayed at the General Electric company's plant in Newark, N. J. Successive stages in artificial illumination were shown, from a crude shell-shaped container in which oil and wax were burned about 600 years before Christ, down to the electric light of today, represented by a bulb of 30,000 volts.



From Oil Dishes to Brilliant Electric Bulbs, the Story of Man's Development of Illumination at a Glance



© Harris & Ewing
Part of the Easter-Monday Egg-Rolling Crowd on the Rear Lawn of the White House, When Thousands of Gayly Painted Eggs Are Rolled down the Hill in the Background

Every Day a Holiday at the White House

There's Always Company Arriving and, to Add to the Festive Atmosphere, Comes a Constant Stream of Gifts

THERE'S a place in the United States where every day is a holiday and where the Christmas spirit, at least that part involved in receiving presents, flourishes 365 days in ordinary years and one more in leap year. The place is the White House at Washington and the recipient of all this attention is the president of the United States.

The holiday spirit is not his choice or desire, in fact it sometimes interferes seriously with his work, but when virtually every visitor to Washington insists on a call on the chief executive he perforce becomes a party to the celebration. Anyone who regrets that Christmas and birthdays or other gift-giving occasions come so seldom may envy the president's annual crop of presents, which runs around 2,000 or so a year, with rarely a day passing without anywhere from a few to a couple of dozen arriving. And the list of gifts covers about everything from animals to framed poems.

Kangaroos, clothes and walking sticks; pocketbooks, pictures and prunes; toys, tools and tobacco—the list of things sent President Coolidge in the last year is almost endless in its variety. It takes a special clerk to keep track of all the gifts and see that the donors receive the treasured note of acknowledgement on the White House stationery.

Not all gifts are accepted. If the White House suspects an effort is being made to use the president for advertising purposes, the present is politely rejected. Last fall President Coolidge declined to accept an apple pie from his own home state Vermont because his name might be thereby linked with publicity for an eat-more-apples week.

More than half the gifts received by the president in a year are books. Some are sent by publishers, some by the authors, and many come from individuals who have read and enjoyed a book and pass it on to the occupant of the White House in the hope that he may find the same enjoyment. Framed mottoes and poems ar-

rive by the dozens each year, most of them from women. Photographs and drawings of the president and pictures of babies named for him constitute another large part of the gift shower.

Fruits, groceries and household supplies arrive in wholesale lots from admirers every week. The Thanksgiving and Christmas holidays always bring from one to a half dozen or more enormous turkeys. Housewives who pride themselves on their jellies, their cakes or their beaten biscuit send generous samples, and farmers pick their choicest produce.

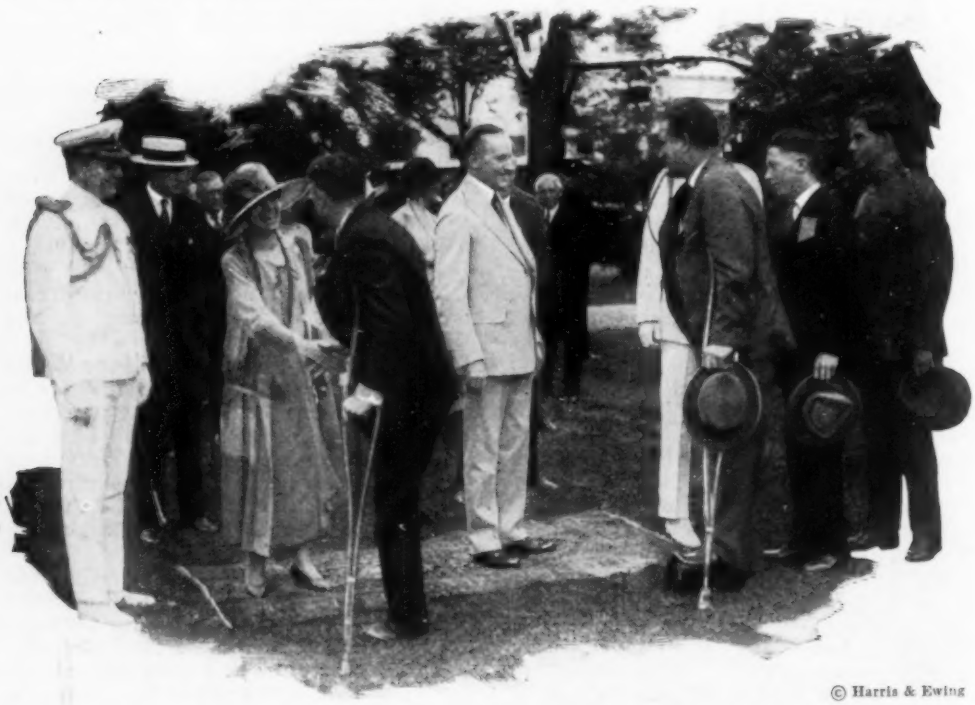
The idea behind many of the gifts lies in news stories about the president. One day he advised a delegation of schoolboys to wear suspenders and as a result himself received some six dozen pair. His electrical horse attracted quite a bit of attention, and a manufacturer immediately brought out a children's size exerciser and sent several dozen to the White House with the request that the president give them to Washington children at Christmas. On his vacation in Vermont Mr. Coolidge tried his hand in the hay field, and a gift of a pair of overalls and a rake shortly followed. He tinkered a bit about his father's farm, and the postman shortly delivered a saw and a screwdriver.

With the perpetual tide of callers, who make every day an event at the White House, it takes a well-oiled machine to keep the business of the government running smoothly. The president must attend to his office, meet all delegations, pose several times a day for his photograph, surrounded by the delegates, deliver speeches from the steps to more important committees, shake hands once a day with all comers, meet distinguished visitors, confer with the cabinet, and in between find time to eat and take exercise.

Despite all its ramifications, the business of the executive mansion moves so smoothly and mechanically that the thousands of visitors are rarely conscious of the behind-the-scenes side of White House life.

Easter is the most crowded period of the year in Washington, with thousands of school children and teachers spending the vacation there sight-seeing. The city is at its best then, with the famous Japanese cherry trees in full bloom, and the egg rolling to see.

All in all, life in the big white mansion is a fairy-story existence in which week days never come, but it is known that every president soon begins to long for a bit of quiet and peace.



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President and Mrs. Coolidge Receiving a Delegation of Wounded War Veterans at a Garden Party for the Soldiers Receiving Treatment at the Hospitals near Washington

While Natives Gather the Eggs in Crates and Wheelbarrows, the Big Birds Walk Unprotestingly among Them, Apparently Unaware That Their Nests, Exposed on Rocks, Are Being Robbed

TONS OF BIRDS' EGGS GATHERED FROM PACIFIC ISLAND

Natives periodically reap a rich harvest in albatross' eggs when they visit the little island of Laysan, one of the Hawaiian group in the middle of the Pacific ocean. Literally tons of the eggs are picked up at one gathering. They are shipped to markets on other islands near by. The birds are generally too slow to catch fish, but live on small shellfish and can swim and fly with equal facility. Their "singing" is said to bear a close resemblance to the braying of an ass.

APPLE-TREE DISEASE TREATED WITH MERCURY COMPOUND

Development of a method for the control of crown gall, a disastrous disease that attacks root-grafted apple trees is reported by the department of agriculture. The system involves the use of a recently prepared organic mercury compound which is said not to injure the roots of the trees. In experiments conducted during 1925, of 2,619 grafts treated, little more than six per cent were afflicted with galls at digging time, while the same number of untreated specimens showed the disease in much larger proportions, almost thirty-three per cent of the lot being infected. In handling the trees, the experimenters used precautions similar to those practiced by surgeons. Implements were carefully sterilized and cleaned with disinfectant, for the disease is caused by a germ. It is believed that the new remedy promises savings of millions of dollars annually, as the gall commonly causes losses of twenty-five to fifty per cent in grafted apple trees, and sometimes as much as ninety-five per cent.

VIOLIN PAD OF SPONGE RUBBER EASES PLAYER'S POSITION

Readily adapting itself to the shape of the neck and shoulder, a cushion of sponge rubber to support the violin, enables the player to assume an easy position, prevents fatigue and, in the case of beginners, helps them acquire correct posture and bow handling. The cushion slides back and forth on a movable arm, which is pivoted to a small bracket attached to the chin-rest mount so that almost automatic adjustment is made to any style of play.

Upper View Shows Cramped Position of Player without the Violin Support; Lower with It in Place, Permitting Greater Ease

Basket of Smelt and Scenes While Taking Part of the Annual Run from the Cowlitz River, Washington; the Fish Ascend Fresh-Water Streams for Spawning in Such Numbers That They Are Easily Scooped Up with Basket Nets; for Years, Little Use Has Been Made of Them, but Packing Plants Are Now Salting and Shipping Them to the Orient

SMELT PRESERVED BY SALT ARE SHIPPED TO THE ORIENT

For many years, fishermen have been perplexed to find use for the billions of smelt that annually appear in the rivers of the Pacific northwest for the spawning season. They come in such numbers that they can be easily caught with scoop nets by persons standing on the banks, but while considerable quantities have been shipped to the city markets, the great bulk of the run has never been utilized. Recently, a new industry has been created in one district in salting and packing the fish for shipment to China, Japan and other parts of the orient. The first pack aggregated 500 tons, and plans have been made for extension of the industry. The smelt, in size and appearance, resemble silver trout. The meat is white, oily like that of a salmon, and there are few bones. About six of the fish make a plentiful meal for one person.

SHOE-SOLE PAD FOR BOWLERS PREVENTS SLIPPING

Quickly attached to ordinary street shoes, a durable pad, patented by an eastern inventor, prevents bowlers from slipping, saves the shoes and makes purchase of an extra pair unnecessary. It is securely held by tabs and a short strap, and can readily be adjusted to widely varying sizes of shoes. A pair of the pads occupies little space and can be carried in the pocket.

¶The Popular Mechanics' Bureau of Information offers its free service to all readers of our magazine. Names and addresses of manufacturers and dealers in articles described will be promptly furnished by addressing the Bureau.

RADIO CABINET AIDS THE DEAF BY SOUND VIBRATIONS

Radio has been adapted to the treatment of certain forms of deafness in a cabinet which amplifies sounds. The intensity of the tones can be widely varied to suit the needs of the patient, who wears headphones and endeavors to hear music or speech from a phonograph record or the human voice spoken through a telephone transmitter into the cabinet. The vibrations stimulate blood circulation in certain parts of the ear, help to loosen the small bones and muscles if they are too rigid, and thus aid nature toward the restoration of normal hearing. Several persons may receive treatment at once with this apparatus, and an additional advantage is that a deaf person may hear the sound of his own voice by speaking through the mouthpiece himself.

Top of Radio Sound Amplifier, Showing Controls, Tubes and Meters Which Indicate Volume; Phonograph in Front, to Furnish Music for Test

LINERS TO CARRY AIRPLANES TO SHORTEN VOYAGES

Two steamers for passenger service between the United States and ports on the Mediterranean are to be equipped with facilities for carrying and launching amphibian airplanes from their decks, according to news dispatches. The innovation will permit passengers to reach their destination as much as two days before regular schedule time.

Time and Money-Saving Tools

Is the Egg Good? Mirror Cup, Below, Quickly Answers the Question; a Clear Reflection from Glass Indicates Unspoiled Egg; Spots or Streaks, Doubtful

Funnel Top Transforms Fruit Jars into Measures; While Spout Permits Pouring without Spilling; Tube Is Handle and Air Vent

Clamped to the End of Ordinary Toothbrush, an Auxiliary Set of Bristles Helps in Cleaning Artificial Sets

Glass-Tipped Caster Permits Sliding Furniture over Floors without Damaging Wood or Rugs

Women Who Make Their Own Clothes Can Mark Their Skirts without Assistance, While Wearing Them, with Simple Arrangement at Right

Anyone wishing further information on devices described in the editorial pages can

for Woman's Workshop in Home

Unpleasant Odors in the Refrigerator Are Absorbed by Substance Held in Wire Cone; Heating Renews the Material

On This Improved Gas Range with Special Dampers, Cooking on Cast-Iron Top, Baking and Heating Water in Coil Can All Be Done at Once with Only One Burner; It Utilizes Much of the Heat Lost in Ordinary Range

Lightweight Baby Carriage Has Package Carrier in the Back; at Right, Spring-Wire Catch on Pole Keeps Clothesline in Place Even When There Is a Heavy Wind

obtain it by addressing Bureau of Information, Popular Mechanics Magazine, Chicago.

Arrow Points to Automatic Holder in Place at Top of Door and Entire Brace Is Shown Below; Slight Push on Door Releases It

AUTOMATIC HOLDER FOR DOORS PREVENTS SLAMMING

Easily adjusted and sure in operation, automatic holders for the garage doors prevent damage to the car or to the doors themselves and make it unnecessary to use bricks or other makeshift props. A latch engages a catch to secure the doors, and in closing them the leaf is opened a trifle wider, permitting the catch to be released. This arrangement prevents the wind from closing the doors.

STORIES OF PREHISTORIC LIFE TOLD IN COAL BEDS

Scenes from Jules Verne's "A Trip to the Center of the Earth" and what the English professor saw as he journeyed down one of the craters of Iceland and out through a volcano in Italy, can almost be duplicated on a scientific basis by interpretation of the fossils discovered in coal beds and in the layers of rock over the deposits. Form, texture and size of plants and trees that flourished ages before history was written by man, are revealed in the natural record left in silts that hardened into stone. "freezing" the imprint of ferns and leaves as an album presses specimens placed between its pages. Prof. A. C. Noe, of the University of Chicago, visions a typical coal landscape of that early age as an enormous swamp stretching over a territory now occupied by several states. Vegetation was prolific and tropical in character, but practically odorless and monotonous in its prevailing greens, yellows and browns. Trees bearing tufts of narrow leaves and covered with bark that had scales like those of an alligator's skin rose to a height of 100 feet. Their only living relative today is the small club moss with which gardeners trim bouquets and flower beds. The trees propagated by spores which contained oils and other fats as food for the young plants. Cannel coal today is rich in oil because of the quantity of these spores in it. This was also the age of the tree ferns, similar in appearance to those now found in New Zealand and the South Sea islands. The absence of regular flowering plants was a distinguishing characteristic of the period. They did not develop extensively until centuries later, when pollen-bearing butterflies and bees appeared. No mammals existed, reptiles were small, and millions of years elapsed before the first great dinosaur was born. The swamp waters were filled with fish and odd crustaceans; oysters and clams could be found in abundance, while huge dragon flies, some with a wingspread of thirty inches, flew through the air. After thousands of years, the sea rushed in and covered this huge swamp where the great

coal fields of the east and the middle west are now being developed. Shales formed by this inundation preserved some of the evidence of the former swamp vegetation. Another long period elapsed and the sea receded giving opportunity for a second swamp and more vegetation, but it returned, burying the new growth and forming another coal seam.

REACTION TO FEAR MEASURED BY EYE PUPILS

That emotion can now be described quantitatively, is the assertion of two scientists at Columbia university who have been conducting an interesting series of tests with human subjects in an effort to measure their reaction to fear. While the person under observation is seated in a darkened laboratory with his hands fitted into cuffs, a pistol is suddenly discharged close to his head or a noisy automobile horn is sounded or he feels the writhing coils of a large snake unexpectedly placed about his neck. If his eyelashes flicker or the pupils of his eyes dilate the least bit, instruments record the fact and how much, while other devices register changes in pulse and blood pressure. About the subject's waist is strapped an apparatus which transmits variations in his breathing to a chart. Before the fear stimulus is introduced, the normal pulse, blood pressure and respiration are recorded by means of the instruments. The sudden variations of the needles as the person is disturbed, give the experimenters a clue as to just how much he reacted. The scientists explain that they regard their work as of chief interest to psychologists, with little practical value to science in general. They hold that there is a relation between dilation of the pupils, quickened pulse and other manifestations of fear and are seeking that correlation.

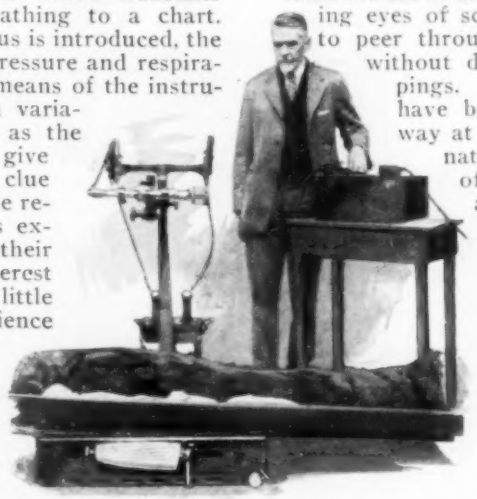
Smashing through Pane of Plate Glass at Sixty Miles an Hour, Motorcyclist Received Only Two Small Cuts on Face

CYCLIST RIDES THROUGH GLASS AT SIXTY MILES AN HOUR

Crashing through a huge pane of glass erected within a frame support, a daring English motorcyclist suffered only two slight cuts on his face. His speed was sixty miles an hour, but cameras "stopped" the action almost perfectly, even to registering tiny fragments broken off by the impact. One side of the pane was seen just falling from the edge of the frame.

X-RAY PHOTOS OF MUMMIES REVEAL ANCIENT SECRETS

With the aid of an X-ray outfit, the prying eyes of science have been able to peer through ancient mummies without disturbing the wrappings. Several specimens have been examined in this way at the Field Museum of natural history. Study of articles of personal adornment and evidence of various physiological facts as revealed by the X-ray pictures enable the experts to gather data concerning the health and habits of persons who lived thousands of years ago. Among them was an Egyptian mummy believed to be 9,000 years old.



Without Disturbing Wrappings, Scientists Can Examine Interior of Mummies by X-Ray Photographs

CANADA TO HONOR WAR HEROES WITH NATIONAL MEMORIAL

Model of Proposed War Memorial to Be Erected for Canadians near Ottawa

In commemoration of the sacrifices and services of Canadians during the World War, a national memorial is to be erected at Ottawa. The prize-winning design, selected from plans submitted by artists and sculptors from all over the world, shows a procession of soldiers passing through an arch as though in triumphal celebration of victory. The work will cost approximately $100,000, it is reported. The statue was designed by Vernon March of Kent, England.

WHITE PAINTS ARE REALLY GRAY TESTS SHOW

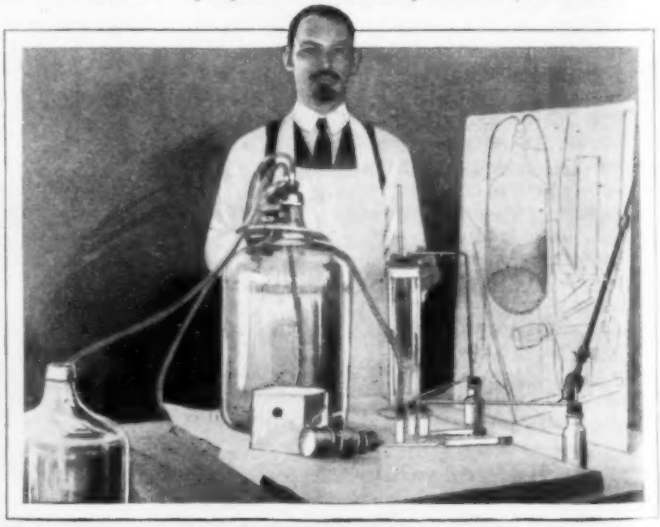
That all our so-called white paints are really gray, is the conclusion of chemists at Cornell university after a series of tests. They found that light was absorbed to a slight degree, so that the paint reflected less than was shining upon it. The ratio between the amount of illumination thrown back and the amount reaching the paint surface, the experimenters declare, may be taken as a measure of the brightness of the paint. The chemists say that the ability of a paint to obstruct the transmission of visible light rays and its ability to obscure the surface upon which it is applied, are really the same thing. During the tests, it was discovered that when a small amount of dark pigment, such as carbon black or Prussian blue, was added to white paint, there was a much greater increase in the "hiding power" of the film than decrease in its brightness.

EARTHQUAKES PROVE BLESSING INCREASING FLOW OF SPRINGS

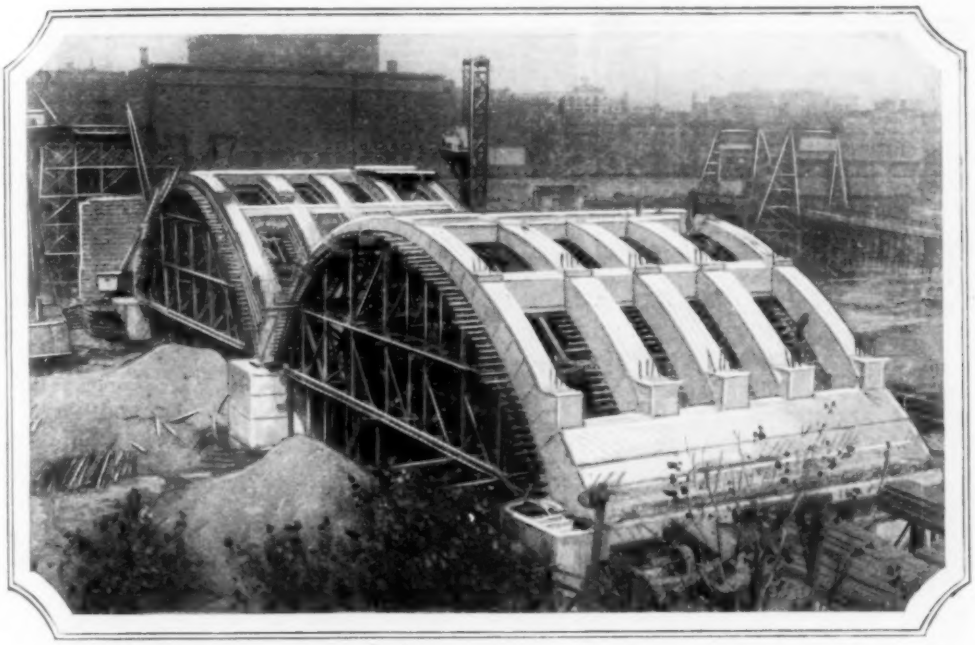
While the recent earthquake in Santa Barbara, Calif., did great property damage, it left an unexpected compensation by increasing the flow from subterranean springs. The waters are filled with minerals and are considered of medicinal value. Scientists declare that the Japanese earthquakes likewise have been blessings in disguise, for they have been instrumental in exposing deposits of valuable ores or have made access to them possible.

STUDY ODORS INSECTS PREFER IN ORDER TO POISON THEM

With the aid of apparatus which shows which odors insects like best, a scientist in the department of agriculture devises bait for traps, or for poison dishes, to destroy various pests. He has discovered that insects of many kinds are guided by the sense of smell in selecting food and prepares lures likely to attract them.



With This Complicated Apparatus, Scientist Discovers What Odors Various Insects Prefer So That He Can Prepare Poisons



The Romance of the Molders of Stone

Concrete Covers the Land and Sails the Seas in the Form of Ships, All in One Generation

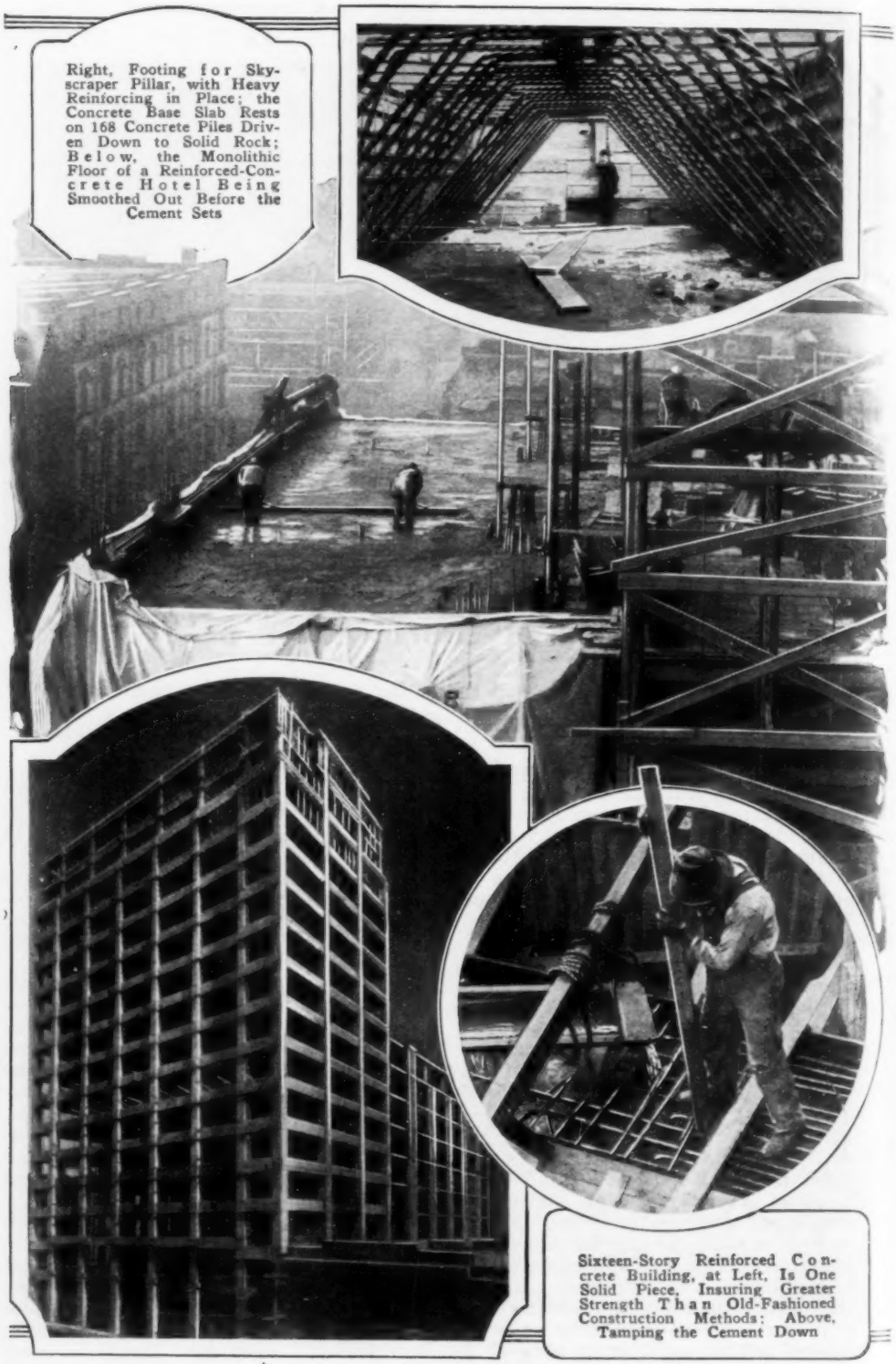
FROM a crude and little used product hardly thirty years ago, in the days when the automobile was young, cement has leaped to the fore as the world's most amazing building material. Hardly a day passes but some new use is found for poured and molded stone, one of the latest being the construction of automobile bodies in Europe.

Thirty years ago cement had begun to supplant stone slabs for sidewalks, and the government built a small barge-canal lock of it out in the Illinois prairies. The material was not new, but had been known, and used, for ages. Foundations of the Roman temples, made of poured concrete, are still standing long after time and the elements have cracked and felled the marble columns and arches. The walls of the House of Augustus, poured in 36 B. C., show every grain of the crude wooden forms in which they were molded.

Concrete really came into its own about the time that the automobile made better roads necessary, and at the same time engineers searching for a new, strong and quickly erected factory-building material turned to cement for the answer. The steel-frame skyscraper had begun to revolutionize building practice with the possibility of a self-supporting framework, to which thin walls could be attached to keep out heat and cold and provide privacy. A few crude experiments in concrete construction, followed by the development of special apparatus and the invention of reinforcing steel, started concrete on its way.

From that rough start, one of the largest industries in the country has grown. The invention of the rotary kiln, huge horizontal cylinders, hundreds of feet long, in which the powdered rock can be cooked into cement, speeded up production. Enormous crushers mash the rock brought from the quarries, the big kilns subject it to intense, fusing heat, and crushers again reduce the caked cement to its final powdery form.

From the powdery dust, mixed with water, sand and gravel and reinforced in many cases with bars of steel, come houses, offices, factories, roads, bridges, dams, canal locks, breakwaters, amphitheaters, grain elevators, coal pockets, barns, silos, chimneys, troughs, fence



Right, Footing for Skyscraper Pillar, with Heavy Reinforcing in Place; the Concrete Base Slab Rests on 168 Concrete Piles Driven Down to Solid Rock; Below, the Monolithic Floor of a Reinforced-Concrete Hotel Being Smoothed Out Before the Cement Sets

Sixteen-Story Reinforced Concrete Building, at Left, Is One Solid Piece, Insuring Greater Strength Than Old-Fashioned Construction Methods: Above, Tamping the Cement Down

posts, ornamental light posts, telephone poles, benches, sundials, bird baths, vases, urns, pedestals, lawn rollers, laundry tubs, statues, tombstones and even outer coffins.

Poured as a liquid, it becomes, in a matter of hours, a rock that grows harder and harder with age. It resists both fire and water and, when properly made, stands up under the roughest treatment. On the sea it is represented in many ships, and it travels on land as concrete freight cars.

The amount of it used in the United States last year was sufficient to have built thirty-four replicas of the great pyramid of Egypt, which 100,000 slaves consumed twenty years in building, or a total production for each slave of thirty cubic yards of masonry in twenty years. Compared to that, working with liquid stone and modern methods, five cubic yards can be laid now for each man of the crew in a ten-hour working day.

Huge Reinforced-Concrete Tile Section and, Left, Spray Gun Being Used to Coat a Fence with Liquid Stone

Boys at Mooseheart, Ill., Home of the Moose Orphans, Learning to Model Attractive Ornamental Pieces from Cement, Finishing with Sculptors' Chisels

Roads alone, during 1925, absorbed something more than twelve and one-tenth million cubic yards of concrete paving, but the production of automobiles more than kept pace with the extension of the hard highways, so that the immense surface of roads laid was not much more than enough to stand the new cars on. The output of roads equaled three cubic yards for each car built during the year.

The total consumption of concrete last year, according to estimates of the industry, was 103,000,000 cubic yards, which fell only a few million yards short of enough to have duplicated the famous Great Wall of China, a job which took 300,000 soldiers and all the convicts and dishonest officials in the empire fifteen years to build. With modern concrete equipment the 300,000 soldiers alone could have mixed enough liquid stone in eighty days to have built the wall.

Spraying Mine Walls with Cement to Prevent Dust Explosions, Above; and, at the Right, Movable Forms Used to Shape Concrete Flume

It is because of its plastic features that concrete has become the premier building material of the age. From the crude cement blocks of a decade ago to the poured stone of the present, which looks and wears like granite, is a long step in one direction, and working in a reverse way, the forward step from painstakingly carved granite statues of the past to the colossal cement-cast "Fountain of Time" of Lorado Taft is an equally great advance.

Real stone which can be carved with ease and which improves with age is rare. The delicate tracery that embellishes the famous monastery at Lisbon, erected as a tomb for the discoverer of the sea passage to India, was made possible by a supply of chalkline limestone which carved as easily as chalk itself, but which, when exposed long to the air, became hard as rock. With modern cement methods, the same effect can be obtained in a fraction of the time, with day laborers instead of skilled artists, and in addition, by mixing color with the cement or using granite particles as an aggregate, any tint desired can be obtained.

The new material, besides being plastic, can be handled in such a wide variety of ways that its applications are almost endless. From being poured in forms or molded into blocks, it is now sprayed on with a compressed-air gun in less time and with better results. Coated over wooden piles in this way and held in place by metal reinforcing, it protects the piles from the ravages of the destructive teredo.

In building construction it has been used for poured columns, beams and girders rising twenty stories or more above the ground, reinforced only by a slender network of steel bars and wires, and even the lofty steel-frame building has its iron pillars incased in cement.

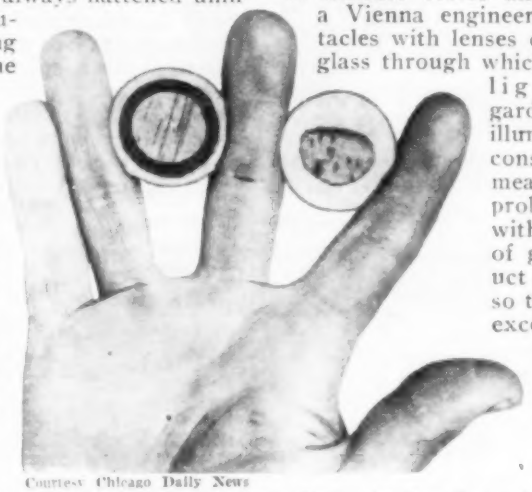
Cement railroad ties are being tried out to replace wood, and the president of one big railroad—the Pere Marquette—predicts that the railroad of the future will have an entire roadbed of cement, giving a stronger and more even surface than gravel fill, and permitting trains, equipped with ball-bearing axles, to run with almost the speed of airplanes.

FOUR THOUSAND LAMPS DAILY GOVERNMENT'S DEMAND

More than 1,500,000 electric lamps are purchased by the United States government each year, or over 4,000 daily, for the manifold illuminating systems of public buildings, battleships, laboratories, offices and warehouses. The demand includes almost every size of light from tiny bulbs for the lamps used in surgical operations to the big ones for searchlights. Samples of every type of light purchased are tested by the bureau of standards, which also does similar work for private concerns.

NEW CORE FOR "LIVELY" BALL TO IMPROVE GAME

To make baseballs more uniform in "life" and flight and to stabilize hitting, a cork-cored sphere designed for use of the National league this year has two coats of rubber instead of one. It is expected that this will keep the "live" center from getting out of shape so easily, thereby preventing exposing more rubber on one side than on another and the uneven hitting that is likely to result. The so-called "rabbit ball" has been widely discussed in sporting circles for the last four years, as it has had an important effect on the number of home runs and the general conduct of the game. Walter Johnson has said on this subject, "No two balls can be made exactly alike; it can't be helped. Sometimes the same ball will have two or more degrees of liveliness, depending on the side on which it is hit. The cork center is always flattened unintentionally in manufacturing it, causing certain sides of the rubber coat, which is pressed into a sphere, to contain more rubber than the other sides. If the impact of the bat chances to meet the ball upon the side where the rubber is the thickest, it sails faster and farther than would be the case if the ball is hit in a place where the rubber happens to be thinner."



Courtesy Chicago Daily News

Baseball Core at Left Keeps Shape with Two Coats of Rubber; at Right, Result of Only One Coat

HOW PHONES HAVE IMPROVED SHOWN BY OLD RECEIVER

Included in the semicentennial exhibit of the telephone company in San Fran-

Today and Yesterday in Telephone Equipment; the Box Affair Is Bell's First Receiver

cisco was the first receiver made by Alexander Graham Bell. Its cumbersome size, exposed wiring and unhandy shape are in sharp contrast to the trim units developed during the past fifty years of telephone progress.

DAYLIGHT GLASSES FOR DYERS AID IN COLOR TESTS

To enable dyers and textile workers of various kinds to detect the true shades of delicate colors under artificial lights, a Vienna engineer has devised spectacles with lenses of a special kind of glass through which the effect of daylight is obtained regardless of surrounding illumination. They are considered a simpler means of solving the problem than lamps with globes of this kind of glass, for the product is costly. It is made so that it filters out the excessive red and yellow rays present in most forms of artificial lighting, restoring the balance of blue and violet rays and the desired daylight effect.

MOVIE TICKER FOR BROKERAGE SAVES MARKING BOARD

Sparing the time lost and the mistakes made in chalking the reports on a blackboard, a movie ticker in use at the Chicago board of trade shows the stock quotations directly from the receiving instrument on a transparent screen. Letters and figures are projected from a specially prepared tape instead of the usual paper ribbon. The characters are easily legible, being several inches high and, as the "film" moves from right to left, the latest as well as several of the preceding quotations are visible at the same time.

Reading Stock Quotations from Movie Ticker; Figures Are Projected from Transparent Tape Directly from Receiving Instrument

POISON WAR AGAINST COYOTES DOUBLES NUMBER OF SHEEP

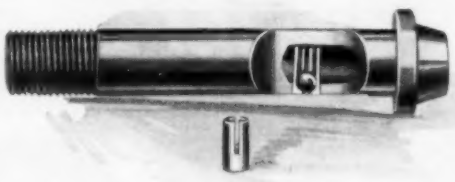
That the poison campaign waged against coyotes and wild cats in a California county is producing good results is seen in the fact that the number of sheep has doubled during the past two years. This is largely due, officials say, to comparative freedom from the depredations of the wild animal killers. Before the poison war was started by the state, federal and county departments, one stockman alone lost 400 sheep out of a herd of 9,500 during the summer period of four months. Last year, only fifteen out of a flock of 7,500 were killed. Where some 200 lambs were lost to coyotes and other marauders among 4,000 ewes, only four were reported killed after the poisoning work. Ranchers say that they are now able to raise turkeys, pigs and chickens on the open ranges with almost no loss, whereas inclosures were necessary before.

HARNESS GEYSERS IN ICELAND TO GROW GARDENS

Visions of Iceland as Europe's kitchen garden may become a reality, to a degree at least, for geysers there already have been used in supplying laundries with hot water, and it is now proposed to pipe the flow under the ground and utilize the heat to stimulate the growth of plants and vegetables. This already has been done in greenhouses as an experiment. Potatoes, planted earlier than possible outside, developed much more rapidly, and flowers have been grown with success.

AUTO BOLT WITH OILING VALVE IMPROVES LUBRICATION

Oil is distributed evenly and in the proper amounts to parts of the automobile chassis from a special type of bolt now on the market. The lubricant is controlled by a ball-and-socket valve in the bolt, situated between the oil-cup reservoir and the bearing. This valve prevents escape of the oil when the car is standing still, but when it is in motion, there is sufficient vibration to cause the ball to move, allowing enough oil to pass out to preserve the necessary film for proper lubrication. The design is suited especially to kingbolts and to those located in springs and tie-rods.



Bolt Cut Away to Show the Oil Compartment and Ball-and-Socket Valve to Regulate Flow

Radio-Battery Charger for Farm Lighting Plant

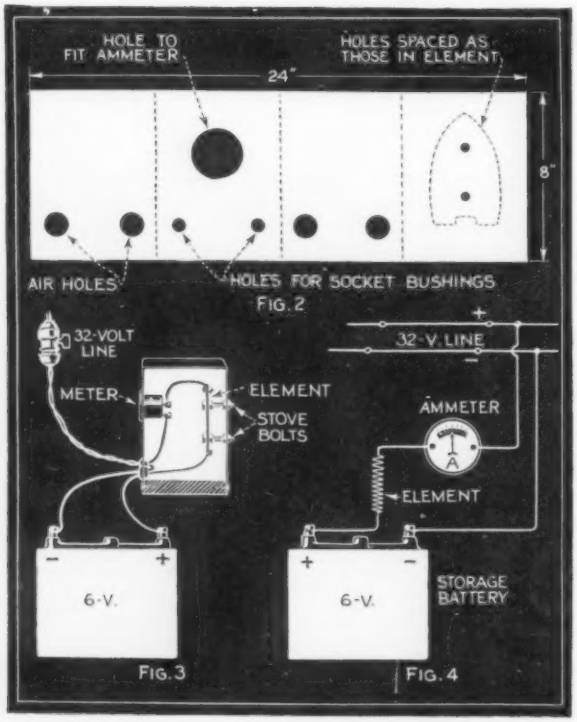
By E. J. BACHMAN

CHARGING the 6-volt radio storage battery from the 32-volt farm-lighting plant is a simple matter if a suitable resistance is used in one of the connecting leads, and the polarity of the connections is correct. It is not a good plan to tap off the A-battery supply from the plant itself as many try to do. A good 6-volt radio storage battery costs very little and will last a number of years if properly maintained. Regular charging is necessary for best results, and as very few farms are equipped with the current supply necessary to use the standard charging apparatus, many farmers have limited themselves to sets using the small dry-cell tubes. The storage-battery tubes give better results, and the farmer who is isolated from broadcasting stations requires all the efficiency he can get.

To make it easy for the home constructor, a resistance that can be readily obtained in the electrical shops is desirable. It was found that the element from a 110-volt electric iron, which can be bought for $2 or less, met the required specifications, when connected as shown in the diagram. The element was inclosed in a neat sheet-iron box and an auto-type ammeter gives the completed unit a factory-built appearance. The baseboard is 1 by 6 by 6 in.; a piece of sheet or stovepipe iron, 6 by 24 in., is laid out as shown in the blueprint diagram, and the holes are drilled or cut for the meter, bolts, nails and ventilation. The metal sheet is then bent on the dotted lines and fastened to the base with small nails. Rubber-headed tacks are used under the base for feet; after the sides and base have been assembled, mount the element with two ¼ by 2-in. stove bolts and nuts, so that it stands clear of the back and sides, to allow dissipation of heat. The element will warm up in use, but does not get so hot as when used in the electric iron. The ammeter is of the common automobile-dash type, with a 20-0-20 scale, so that it will show the flow of current in either direction. If it is marked "charge-discharge," these indications may be disregarded.

Radio-Battery Charger for Farm-Lighting Plant; Broken-Out Section Shows the Instruments in Position and the Wiring

The two lower terminal lugs on the heating element are connected with a wire or strip of metal, as shown in the detailed illustration; from this point an insulated lead wire is brought out through a rubber bushing, in the front of the case, to a battery clip. This terminal will be positive, as shown in Fig. 4 in the blueprint diagram, so mark this clip with



Above, Construction Details of the Sheet-Iron Box; Below, Wiring Details of the Completed Installation

a cross. The upper terminal of the resistance unit is connected to a short lead of insulated wire and goes to one side of the ammeter; the other terminal of the ammeter is connected to an insulated lead that is taken to one side of the 32-volt socket. The other socket lead is carried through the rubber bushings in the case and out to the negative A-battery clip; the details are clearly shown in Figs. 3 and 4.

Screw one part of the detachable plug into the light socket; the instrument must now be tested for correct polarity with the supply line. Connect the clips to the proper posts on the storage battery to be charged; while watching the ammeter, short the prongs of the plug with a piece of metal and note in which direction the pointer swings. If to the right, then it must swing to the left when the plug is connected in the socket and the 32-volt current turned on. Should it swing to the same side that it did on the shorting test, pull out the plug and insert the pins in opposite holes, reversing it. Shorting the plug in this manner will not harm anything, as the resistance is in series. Connecting the plug in the wrong direction momentarily, will not matter for the same reason. The main point to remember is that, to charge the battery, the indicator must swing in the opposite direction to that in which it swings when shorting the pins of the detachable plug.

Poor Insulation Is Cause of Leakage

To really appreciate the chances for losing the energy picked up by the aerial before it reaches the set, and in the set before it can be built up to the point required for phone or loud-speaker volume, it is necessary to know something of the minute and feeble character of these impulses. The amount of energy picked up from distant stations by the aerial is so small that very delicate instruments are needed to detect its presence. It is the function of the radio receiver to amplify this minute energy and convert it into mechanical power sufficient to actuate the diaphragm of the phones or horn. It must be nursed and guarded so that it will flow along the path by which it is to be built up. To lose any part of it will lessen the volume of the receiver and cause loss of selectivity. Good insulation through the set is necessary to cut these losses to a minimum. The instruments themselves must be of the correct design to prevent loss; in fact, for best results, it is necessary to go almost to extremes in preventing this energy to escape. Radio currents have a tendency to travel on the surface of the conductors and insulators, so that the presence of a little dust or moisture will offer a path for escape. Wood, therefore, is a poor insulator, as is any material capable of absorbing moisture. Many times wood subpanels coated with a black paint or finish, which invariably contains carbon in some form, are used, giving the minute currents a chance to escape. There are plenty of good, cheap insulating materials for panels and subpanels, and these should be used. Sockets of the "mud" type have almost disappeared from the market; this compound contained conductive material causing serious losses. Good sockets are now made of high-grade insulating materials, and are so designed that losses are reduced to a minimum.

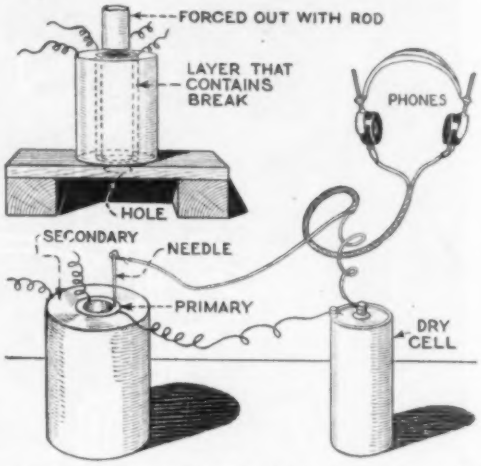
¶Audio-frequency transformers should be mounted at right angles to each other, and 4 to 5 in. apart.

Finding Weak Tubes in Radio Sets

Many fans seem to think that they must be equipped with an accurate tester to locate troublesome tubes in their radio outfits or tubes that are in need of renewal for proper emission. A practical method that has been used for some time, is the following: Obtain a new tube as an extra in case of trouble. Remove the second amplifier tube from its socket and, with the switch cut in, move each tube up one position and note the amplification or tone value it gives. It will not take long to locate the tube which should be reactivated. A tube rejuvenator is the only investment needed, and the cost of an extra tube is of little consequence.

Repairing Audio-Transformers

A defective audio transformer is generally remedied by substituting a new one, although the trouble could be located in the old transformer. It is discarded because the fan has an idea that all the wire in it is ruined, or he does not care to tackle the "miles" of fine wire. However, very few feet of the wire have to be tampered with to locate the break. The trouble in most cases lies in the primary and nine times out of ten not in the winding actually burning out; and as by far the most transformers now in use are the layer-wound paraffin-paper type, it is not difficult to locate the break and repair it. The first thing to do is to remove the core, leaving the primary and secondary windings intact. A simple way to locate the break is to connect one end of a wire to a small needle, and the other end to a dry cell through a pair of headphones, the other post of the dry cell being connected to the winding to be examined. The needle is then slowly forced into the end of the winding; if a click is heard when the point of the needle touches the layer of wire, the wire is unbroken that far. By continuing to push the needle farther in until no click is heard, the exact layer that contains the break can be located. If it happens to be near the outside of the secondary, or the inside of the primary, it can be repaired without much trouble. If it is near the center, it will be necessary to heat the windings so as to soften the paraffin and force these windings apart at the break. This is done as illustrated in the upper left-hand diagram. A small wood platform with a hole in it slightly larger than the defective layer is prepared, and the heated coil is placed over this hole. A cylindrical object that will fit the hole is then placed on the other end of the coil, and force is evenly applied until the windings are telescoped apart.

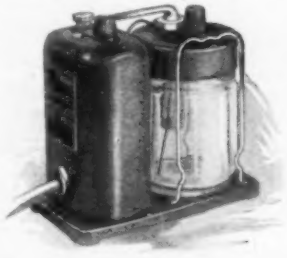


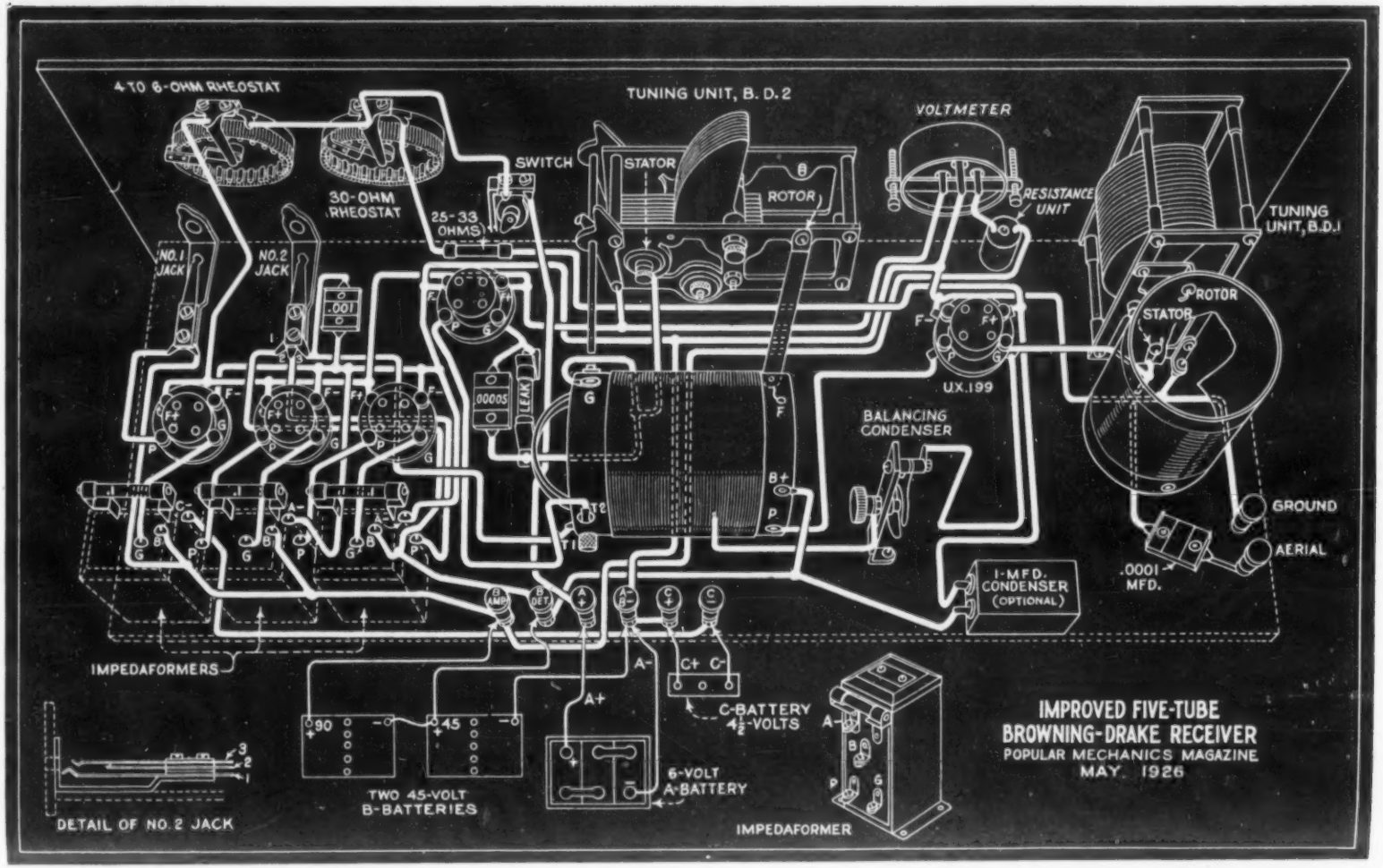
Locating Breaks in Defective Audio Transformers with Headphones in Series with a Dry Cell

When repairing the break, use only rosin for a soldering flux, and in replacing the windings, take care to keep the wire from breaking. If half a layer or so of the coil is lost, it will make no difference in the operation of the transformer. While rebuilding the core, if any trouble is experienced in getting all the laminations in place, try squeezing those that are assembled and then adding more to them.—Watson Brown, Iuka, Miss.

Low-Rate Charger for Continuous A-Battery Supply

A low-rate charger designed for continuous charging over long periods of time is especially designed for dry-cell sets and storage-battery sets having relatively few tubes. The instrument charges both 4 and 6-volt A-batteries at about .5 ampere, and requires very little attention. Operating directions accompany each charger, giving time of operation necessary for the various types of sets. The charger can be so regulated that it can be left on continuous charge, if desired, thus keeping the A-battery up to full charge all the time.




4 TO 6-OHM RHEOSTAT
TUNING UNIT, B. D. 2
VOLTMETER
SWITCH
STATOR
ROTOR
30-OHM RHEOSTAT
25-33 OHMS
RESISTANCE UNIT
TUNING UNIT, B.D.I
NO.1 JACK
NO.2 JACK
.001
.00005
LEAK
ROTOR
STATOR
UX.199
BALANCING CONDENSER
GROUND
AERIAL
.0001 MFD.
1-MFD. CONDENSER (OPTIONAL)
IMPEDAFORMERS
A-
A+
C+ C-
C-BATTERY 4½-VOLTS
90
45
TWO 45-VOLT B-BATTERIES
6-VOLT A-BATTERY
DETAIL OF NO. 2 JACK
IMPEDAFORMER
IMPROVED FIVE-TUBE BROWNING-DRAKE RECEIVER
POPULAR MECHANICS MAGAZINE
MAY. 1926

Five-Tube Browning-Drake Receiver of Improved Design

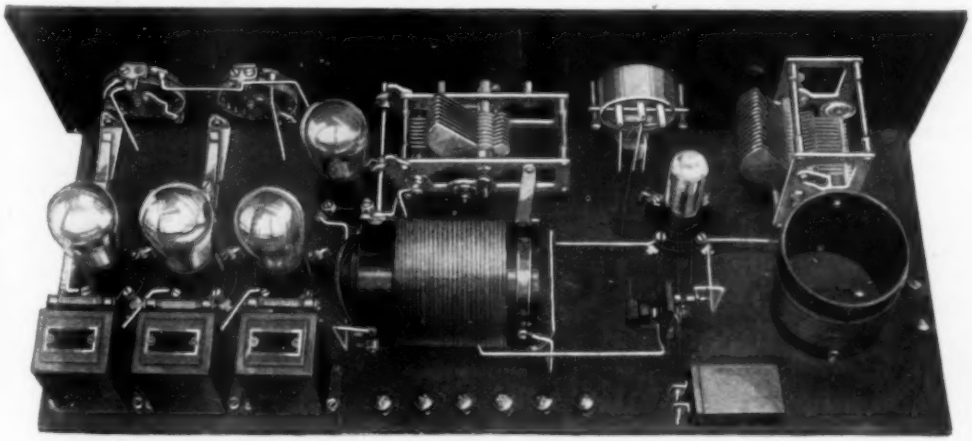
By GLENN H. BROWNING

EVERY broadcast listener desires a radio set which is at the same time sufficiently sensitive to receive distant stations and selective enough to cut out interference and easily separate local stations. The signals received must also have good tone quality. If, combined with these qualities, the receiver is easily built and operated, it is most welcome to the listener. The receiver to be described is selective, sensitive and easily built and, while not perfect, is believed to be a step in the right direction.

The circuit is a combination of old and new ideas, and depends for its efficiency largely on the design of the tuned r.f. transformer used. This 1926 model of the well-known circuit also employs straight-line-frequency condensers, dials of new type, and a very efficient method of impedance-coupled audio amplification. The problems involved were worked out by the writer and Frederick H. Drake, at Cruft laboratory, Harvard university. The particular problem solved was the design of a tuned r.f. transformer, which would give the greatest possible amplification when employed with the tubes now obtainable, the result being, that approximately 90 per cent of the amplification calculated by mathematics was obtained in practice. In this circuit the tuned r.f transformer is used with a regenerative detector, so that one stage of radio amplification suffices for all purposes.

The reader should understand that the purpose of a r.f. amplifier is to build up feeble signals so that distant stations may be received. There is a limit, however, to the sensitivity of any receiver, for noise such as static and "man-made" interference, may be louder than the incoming signals from a very distant station. Then, no matter how sensitive the set may be, only a limited distance can be received before what is known as the static or noise level is reached. Thus, if we have a set which will receive signals up to this level, its sensitivity has reached the practical limit. In the quest for an efficient audio amplifier to combine with the r.f. part of the receiver, laboratory measurements were made on three possible choices, namely, two stages of transformer-coupled audio, three stages resistance-coupled, and three stages of the impedance-coupled type. The latter was finally chosen, for, although it requires three tubes instead of two, only 90 volts of B-battery are needed, and the quality of the received signals is practically perfect. When tested in Popular Mechanics radio laboratory, this receiver had unusually good tone and range.

The layout of the receiver is very simple. The UX-199 tube is placed between the two tuning units, and the audio amplifier at the right of the detector, making the leads short, especially those carrying the r.f. currents. The front panel is 3/16 by 7 by 24 in.; the subpanel, 3/16 by 8½ by 23 in. They should be of bakelite or formica, although the subpanel may be of 5/16 in. wood if desired. Mount the instruments on the front panel first, as shown in the front-view photo. Lay out



Rear View of Completed Set, Showing the Method of Running the Wires above the Subpanel

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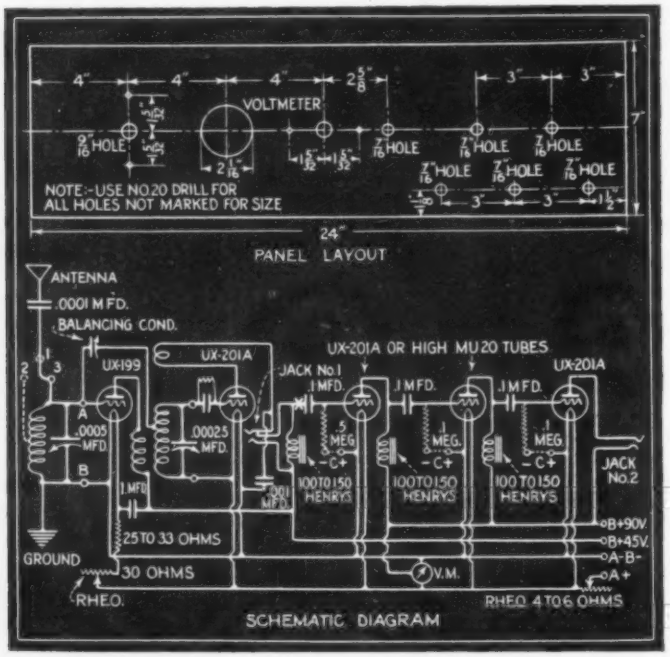
the instruments on the subpanel as shown in the rear-view photo of the completed instrument and the full-page blueprint diagram. It will be noted that the brackets on the first tuning-unit condenser support one side of the subpanel, while the other end is screwed to the frame of the No. 2 jack. Brass machine screws, or inverted binding posts, can be fitted to support the rear edge of the subpanel. The wiring diagram is given in simple detail on the blueprint page, all of the wiring being shown above the subpanel so that the various leads can be easily traced. When wiring the set, however, it is best to run the leads under the subpanel whenever convenient. The rear-view photo and the underpanel view show the leads both above and below. Black-spaghetti tubing is slipped on the leads where necessary to prevent shorts. The schematic diagram is given for those who prefer it to the simplified wiring diagram.



Above, Front-Panel Drilling Template; Below, Schematic Wiring Diagram

It was found, with either a resistance or impedance amplifier, that the r.f. current entered the a.f. circuit and affected the operation of the receiver slightly, sometimes giving a popping noise in the loud speaker when the tickler coil was advanced too far. This was eliminated with a choke coil placed in series with the .1-mfd. condenser at the point marked X on the schematic diagram, and must be used if any other type of amplifier than that specified in the material list is employed. These impedaformers contain a choke coil and .1-mfd. condenser, and the entire unit is employed in much the same manner as an ordinary a.f. transformer. Connections for the C-battery are shown in the large blueprint diagram. This C-battery is for the last audio stage and can be varied to suit the type of tube used. The new UX-type sockets, suitable for either the 199 or 201A tubes, are used throughout the set. The detector and amplifier tubes are the 201A-type; HI-MU tubes can be used in the amplifier stages if desired. If a power tube is desired in the last stage, it is necessary to provide an extra binding post for the required 135 volts. The 1-mfd. condenser, marked "optional," may be omitted in almost all cases where the leads to the B-battery are short, and

MATERIAL LIST

1 bakelite or formica subpanel, 3-16 by 8½ by 23 in.
1 bakelite or formica panel, 3-16 by 7 by 24 in.
1 National tuning unit, Browning-Drake 1-Type-B.
1 National tuning unit, Browning-Drake 2-Type-B.
1 Yaxley (or similar type) 30-ohm rheostat.
1 Yaxley (or similar type) 6-ohm rheostat.
1 Yaxley (or similar type) switch.
1 Rathbun, General Radio, or X-L, balancing condenser.
5 General Radio UX sockets.
1 Yaxley (or similar type) double-circuit jack.
1 Yaxley (or similar type) single-circuit jack.
1 fixed-resistance unit, 25 to 33 ohms.
1 type 17 double-range Hoyt voltmeter.
1 fixed mica condenser, .0001-mfd.
1 fixed mica condenser, .001-mfd.
1 fixed mica condenser, .00005-mfd.
1 gridleak (try from 5 to 8 meg.).
1 gridleak mounting.
3 National impedaformers (these combine an impedance, .1-mfd. fixed condenser and gridleak).
10 binding posts.
1 fixed condenser, 1 mfd., (optional).
1 UX-199 tube.
4 UX-201A tubes.
These parts, as listed, will cost about $56.75.

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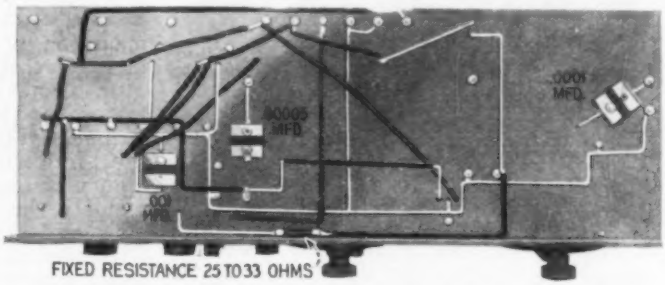
whether or not it helps in balancing the receiver, can only be determined by experimenting. The UX-199 tube is used as a r.f. amplifier, as it is much easier to balance than the 201A-type, and gives approximately the same results. The 33-ohm resistor in series with the filament line reduces the 5 volts across the large tubes to 3 volts for the filament of the small tube, so that the 30-ohm rheostat may be turned full on when maximum signal strength is desired. This rheostat can be used as a volume control so that local-station strength can be reduced as desired.

A very short aerial, say, from 10 to 70 ft. including the lead-in, may be erected for the receiver, and the shorter the aerial the better the selectivity. The aerial should be as high as possible, the writer having used a vertical stretch of about 30 ft. with good effect. A short aerial should be connected as shown in the large wiring diagram, and, if the longer aerial is used, a tap should be made from the aerial coil to a separate binding post and the long aerial connected to this post. This arrangement, which is shown at point 2 in the schematic diagram, keeps the dial readings more nearly together.

The set may be adapted to a loop by disconnecting the first coil from the condenser and connecting the loop to points A and B, as shown in the schematic diagram. However, a short aerial has more pick-up, although stations 1,000 miles away have been received under favorable conditions on the loud speaker with a small loop. In fact, the writer has heard, on a friend's set, a station 400 miles away with no antenna connection at all. This is very unusual, however. For extremely sharp tuning it is suggested that the aerial lead be disconnected from the set under crowded conditions in large cities, when local programs are desired. The set is capable of bringing in stations several thousand miles away when properly built and skillfully operated, but the builder should not expect to get distant stations the first night.

When the set has been constructed, the first thing to do is to balance it so that it will not reradiate. Connect the aerial, ground and batteries, and place the tubes in the sockets. Plug in the phones in the first jack, and tune in a local station with the two dials and the rotor, or "tickler" coil. Then turn the 30-ohm rheostat off, leaving the UX-199 tube in the socket; set the balancing condenser so that the local station is heard very faintly if at all. When this condition is reached, rotating the first dial should have very little effect on the signal strength. This is all done with the 30-ohm rheostat turned off. This finishes the operation of balancing the receiver, and the rheostat can be turned completely on again.



Under-Subpanel View, Showing the Fixed Condensers in Position

In locating stations for the first time, it is easiest to turn the tickler knob to a point where putting a finger on the stator plates of the second condenser gives a click in the loud speaker, and rotating the dial of this condenser should give a whistle when a station within range is transmitting. Turn back the tickler until the whistle disappears and adjust the aerial tuning condenser to the point where the station is loudest.

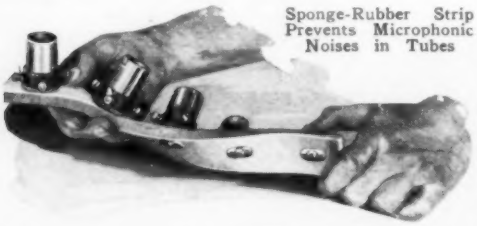
Blueprints for this set, including full-size drilling template and enlarged wiring diagram, may be obtained from the Radio department, Popular Mechanics Magazine, 200 E. Ontario st., Chicago. Include 15 cents to cover postage and packing. Specify blueprint No. 108.

Front View of Instrument Panel

By filing the ground wire flat before soldering it to a water pipe, and by soldering the antenna-wire tip into a copper lug, the contact surface of both will be enlarged, and this has been found to increase the efficiency of some sets.

Cushioning Radio Tubes

Microphonic rings are quite common in many radio sets where the sockets are rigidly mounted on the subpanel. Every

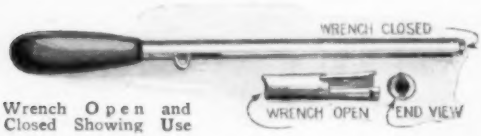


Sponge-Rubber Strip Prevents Microphonic Noises in Tubes

jar in the room is readily transmitted to the tubes and causes distortion in tone. A good remedy for this trouble is a strip of sponge rubber, with the tube sockets mounted on it as shown in the photo. The sockets are fastened by means of screws projecting through both the base and the cushion. The screws are turned up quite tight so that the nuts and washers are pulled up below the underside of the cushion. Glue is then used to fasten the cushion to the baseboard.

Adjustable Radio Socket Wrench

Tightening nuts on the various instruments of a radio set is sometimes rather difficult especially if attempted with a pair of pliers. To overcome this trouble socket wrenches have been put on the market. One, which has been found especially useful, is shown in the illustration. It has adjustable jaws designed to fit many different sizes of nuts. By pulling a thumb adjustment backward the jaws are tightened on the nut, whether this is of the hexagon or the knurled type. The work is done entirely with the hand hold-



Wrench Open and Closed Showing Use

ing the wrench. As it is nearly 10 in. long, it can be used to reach nuts which are otherwise inaccessible.

Magnetic Coupling of Parts Prevents Good Reception

The intercoupling of the magnetic fields of the various instruments in the radio receiver is one of the main causes of unstable operation, and distorting music or speech. Faulty wiring, careless soldering and defective instruments also come in for a fair share of the blame.

Other forms of trouble are easily located, but the invisible fields are more difficult to find. These fields are like halos around the coils, condensers and other pieces of apparatus, and must be diverted either by shielding the instruments or by placing them at critical angles, so that the fields will interact as little as possible. This is often a hard matter for the radio builder to do, so instrument designers have produced coils of the toroid, or "doughnut," type and the binocular form in which the field is confined to the coil. Shielded or "canned" coils and condensers are also available. Grounded shields between the tubes and other apparatus also tend to lessen this troublesome intercoupling.

Rheostat for Critical Filament Control

A rheostat of unusual design, for critical filament control, has lately made its appearance on the market. The resistance is varied by winding a wire from a short-circuiting cylinder onto an insulating cylinder, or vice versa. The cylinders have a positive gear drive, and the wire is kept taut by means of a torsion spring. It is claimed that the minimum resistance of the rheostat is less than .2-ohm. Twenty-four complete turns of the knob are necessary for varying the resistance from minimum to maximum, giving a very fine micrometer adjustment. These rheostats are made in resistances of 6, 15 and 30 ohms.

Hydrometer Only Reliable Tester of Storage Battery

The best check on the condition of a storage battery is obtained with a hydrometer. A voltmeter does not give a true reading of the condition of the battery, as a practically dead storage battery will show a 6-volt pressure. A fully charged battery will give a hydrometer (specific gravity) reading of between 1.300 and 1.285; the half-discharged battery reading 1.200, and a completely dead one 1.100. Never permit the battery reading to fall below 1.200.

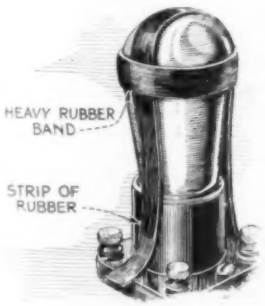
Simple Method of Rejuvenating Tubes

Tubes that have lost their ability to give good reception can be restored almost to their former usefulness by the process of rejuvenation. This consists in applying alternating current to the filament at comparatively high voltage for some seconds, and finishing off with about 8 volts for about ten minutes. If the manufactured unit for this purpose is not available, a homemade device can be rigged up that will accomplish the same results. A bell-ringing transformer of the type having taps for 6, 8 and 14 volts is required; this is connected to the 110-volt a.c. supply line, and the output taken to the filament posts of a tube socket. First determine if your tubes are of the type that can be rejuvenated; if they are of the UV-201A or C-301A types, it is safe to proceed, but do not attempt to rejuvenate other types.

Place the tube in the socket and first apply the full 14 volts for 30 seconds, then keep the tube lighted with 8 volts for ten minutes. These may seem to be excessive voltages, but the tubes will stand them if the transformer is not defective and alternating current is used as directed. It is possible that the tube will burn out under this treatment, but it rarely happens if proper care is taken.

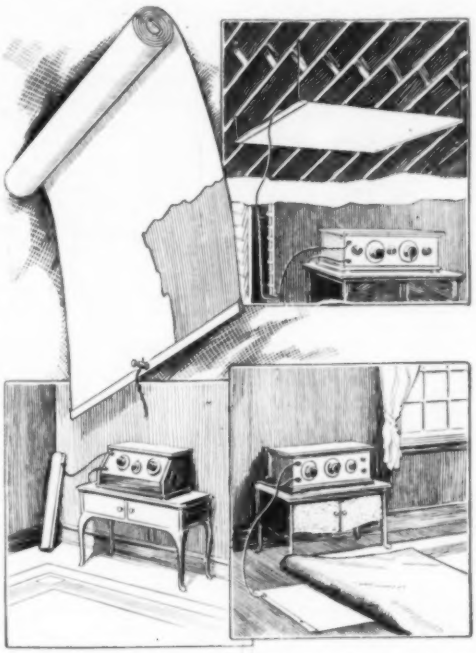
Rubber Bands Help Reduce Microphonic Tube Noises

Owners of radio sets who are troubled with a tube which has become microphonic and produces harsh ringing noises when the set is jarred, can reduce the noises somewhat by using rubber bands as indicated in the sketch. Cut a long, wide and soft rubber band apart, and drape it over the dome of the tube, allowing the ends to trail on the base of the socket. Then stretch a shorter band around the bulge of the tube so it will hold the first band securely in position. This arrangement tends to reduce the vibrations imparted to the glass itself, and will be found a help, especially with a tube that is doing good work otherwise.



Hidden Mat-Type Aerial Saves Space

An efficient mat-type of aerial that takes up very little space is illustrated in the accompanying drawing. The upper-left part shows the aerial partly rolled up, with a section cut away disclosing the wires. The metal strip along the lower edge forms a condenser, and the binding post for the connection to the set is shown in the center of this strip. An aerial of this type can be used in many different ways. It may be suspended in the attic and connected to the aerial post of the set in the usual manner, or spread under the rug, either as an aerial or as a counterpoise. It may also be used rolled up, in which position it is said to be very selective, and as satisfactory as a loop aerial. It is available in 3 by 10-ft. and 3 by 6-ft. sizes. In localities where space is at a premium an aerial of this type minimizes reradiation, and saves roof installations. The fact that it can be hidden is of interest to those who wish to keep as much apparatus as possible out of sight.

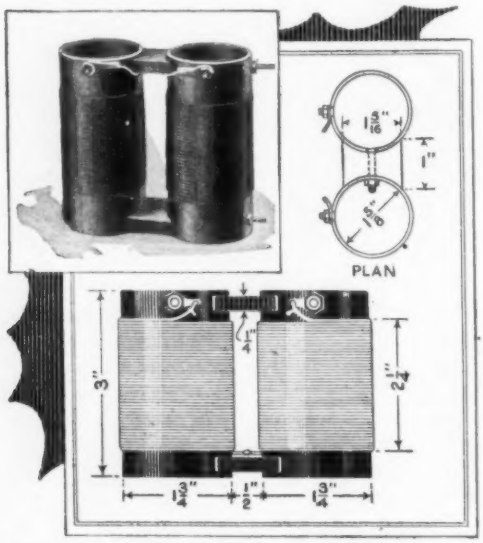


Mat Type of Aerial, Showing How the Wires Are Laid; Inserts Show Various Ways of Using It

¶A new upright B-battery, made specially for portable sets, is 3¼ in. long, 2¾ in. wide, and 5⅝ in. high. It has 50 per cent more capacity than the common portable size and weighs only 2½ pounds.

Building "Binocular" Coils

So-called binocular coils are easier to build than coils of the toroidal or doughnut type, and are ideal for radio-frequency sets. These coils possess the same desirable characteristics, electrically, as the toroidal coils. The insert photo above shows the secondary of a homemade coil of this type. The construction is very simple; two bakelite tubes of 1¾-in. external diameter are used for each coil, the walls being 1/16 in. thick and the length of each tube 3 in. They are wound with No. 22 d.s.c. wire as shown in the lower diagram.



Completed Binocular-Coil Unit, and Right, Section Showing Mounting Screws in Position; Below, Details of Wiring and Construction

When used with .00025-mfd. condensers, 75 turns of wire are wound on each coil, making 150 turns for the pair. The winding occupies 2¼ in. and there are 33 turns to the inch. Of the two coils one is wound clockwise and the other counterclockwise. If .00035-mfd. condensers are used, the number of turns is reduced to 60 for each coil. The winding will occupy 1 13/16 in. on the tube.

After the coils have been wound and the ends of the wire anchored by looping them through small holes, the tubes are assembled, as shown in the lower illustration, by means of two small bakelite spacers, ¼ in. thick, that can be sawed out with a small coping saw. When doing this the bakelite should be clamped to a thin board so that it will not chip. Two small flat-headed brass machine screws finish the assembly. The two coils are then joined as shown in the plan. This completes the secondary of the unit.

The primary is then wound on a slightly smaller tube having an outside diameter of 1½ in. It is space-wound with 29 to 30 turns of No. 32 d.s.c. wire, and then slipped inside one of the pair of secondary coils. Choose the one in which the brass connecting screw is countersunk, so as to permit the smaller tube to slip inside freely.

If desired this primary coil may be moved in or out to obtain a tighter or looser coupling, which is necessary to assure selectivity and prevent oscillation.

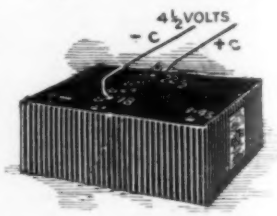
Handle Phones with Care

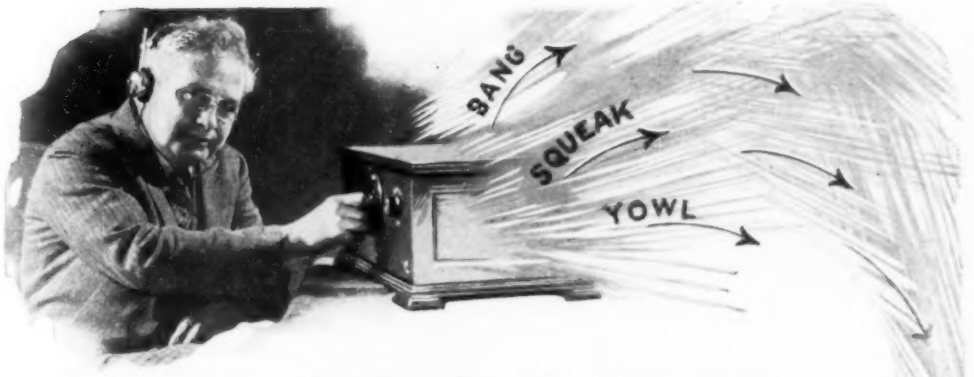
Headphones should be handled as carefully as a fine watch. When correctly built they are delicate instruments and will not stand rough usage. One should never let them drop on the table or floor, nor permit the cords to become twisted, as the tinsel conductor in them is easily broken. See that the terminals are tight, and do not leave phones where they are exposed to dampness, or on a workbench where metal filings are scattered about.

Making the B-Battery Do Double Duty

There are some tricks in the use of batteries with radio receivers which have a decided bearing on operating costs. As is now well known, a C-battery must be used in all sets employing two stages of a.f. amplification, that is, if the B-battery current is to be conserved. When 4½ volts are required for this C-battery, it is not necessary to purchase a separate unit for this purpose. If the reader will carefully inspect the sketch attached, a simple method of securing the effect of a C-battery will be shown clearly.

Most sets have a 22½-volt B-battery in the circuit, as all do not use the heavy-duty batteries. Attach the positive C-lead from the set to the 22½-volt post on the battery and the negative C-lead from the set to the 18½-volt post on the B-battery. It will readily be seen that the 18½-volt post with this arrangement really becomes a negative terminal.—L. H. Georger, Buffalo, N. Y.





Preventing Oscillation to Improve Radio Reception

By F. L. BRITTIN

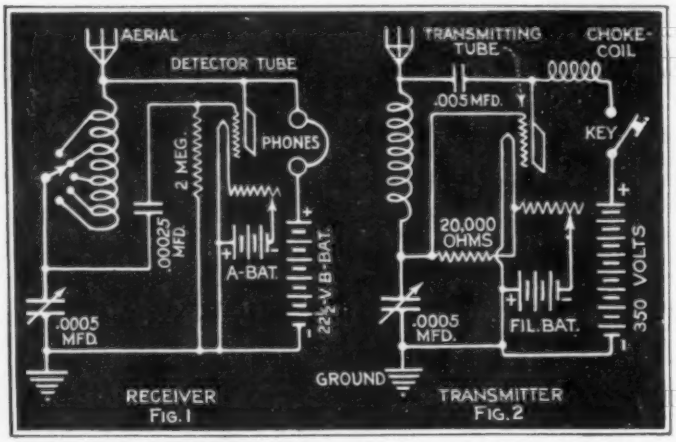
GOOD control is necessary in operating any type of radio receiver, and without this good results are impossible. Better control means clearer signals, and makes possible long-distance reception. A set that is "touchy" and inclined to break into squeals is a set that is hard to tune: uncontrollable oscillations of this type really mean that the set has ceased to be a receiver and has become a transmitter. There is a very close relationship between the receiver and transmitter. Some receivers can actually be used as transmitters of code signals by simply substituting a telegraph key for the headphones or horn, and all that is necessary to cover surprising distances with such a transmitter is to increase the plate voltage.

A well-known type of simple receiver is shown in Fig. 1; note the few changes necessary to convert this receiver into an efficient transmitter, as shown in Fig. 2. This simply means that when your set is allowed to squeal and howl you do not have an equal chance for good results with the man who operates his set with greater skill.

The trouble may not lie altogether with the operator, however, as the set may not be designed correctly. It may need better balancing, and this can be done with neutralizing condensers, potentiometers, the addition of a stage or so of r.f. amplification, or by various other methods which add greatly to the tone, selectivity and range of the receiver.

If you do not care to make changes in your set to prevent such a condition, tune the set carefully so as to reduce this interference to a minimum. This can be done by avoiding the position your controls are in when your

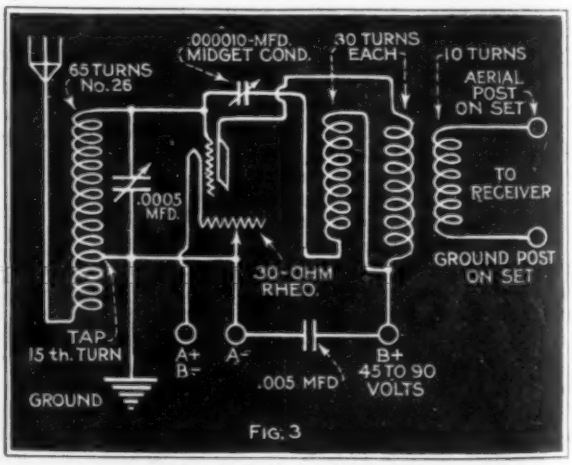
set is whistling or oscillating. It is easy to tell when the whistle is caused by your own set, as then, leaving the regeneration control alone and rotating the tuning dial will cause the whistle to rise and fall in pitch. If two stations are broadcasting on similar wavelengths, they will often cause the set to whistle; if the whistle does not change pitch when the tuning dial is rotated, but merely varies in volume, the trouble is not in your set. Keep the filament supply to the tubes reduced to the lowest point consistent with clear signals and good volume. Turning up the tubes beyond this point will often cause the set to break into oscillation, and also tends to shorten the life of the tubes. Most sets have a control marked either regeneration, tickler, volume or sensitivity; when this control is turned too far over, the set breaks into oscillation and becomes a miniature transmitter sending out waves, and the length of these waves is changed every time you change the position of the tuning dial.



The Close Relationship between Transmitters and Receivers, and the Few Changes Necessary to Turn One into the Other

One of the best methods of obtaining better results, and at the same time adding to the range and selectivity of the set is to construct a non-radiating unit that can be attached to almost any type of receiver. A good example of this type of apparatus is the unit shown in Fig. 3. It consists of a few simple coils and condensers and an extra tube, and can be built for about $15. After you have learned that your set is a squealer, the sooner you build the unit and persuade your neighbor who has a similar offender, to do the same, the quicker you will realize how good your set is on distance, if it has a chance to do its best.

The unit can be built up on a small panel and baseboard. The coils are homemade and No. 26 d.c.c wire is used for all. The coil which is connected to the aerial and ground is wound on a 2¾-in. length of 3-in. tubing. Start ½ in. from the end and wind 15 turns, take off a tap and continue the winding for 50 more turns; this completes the first coil. On a 4-in. length of 3-in. tubing, starting ½ in. from the end, wind 30 double turns. To do this, it is necessary to use two lengths of wire, winding them side by side at the same time, making a double coil 60 turns in total length when connected, 30 of which are in each of the two coils. Connect the end turn of one coil to the first turn of the other; at this point note that a lead is taken to the B-positive binding post. On this same tube, from 1 to 1¾ in. out from the double coil, wind the 10-turn coil to be connected to the receiver. Mount these coil units at right angles and space them 2 or 3 in. apart. Mount the 65-turn aerial coil in a horizontal position with the 15-turn end toward the outside edge of the baseboard



A Simple Non-Radiating Unit That Can Be Added to Most Receivers, Improving Both Range and Selectivity

handy to the aerial post. The other unit is mounted in an upright position with the 10-turn coil at the top. The tube socket can be placed between the coils, and the rheostat and condensers are then mounted on the front panel. Arrange the binding posts on either side of this panel in positions handiest to the points to be connected. Fasten the coils to the baseboard with small brass brackets. The small neutralizing condenser can be mounted either on the baseboard or the panel. When connecting this unit to the receiving set, bring additional A-negative and A-positive leads from the corresponding posts on the receiver. It is assumed that the B-battery of the receiver totals from 45 to 90 volts. If the set uses a 22½-volt B-battery only, add more units to bring the total voltage up to from 45 to 90 volts, leaving the detector plate at 22½ as before. If the receiver is of the type using two or more tubes, the 90-volt B-battery is sufficient. Take the 90-volt B lead to the B-positive post on the unit. If there is a previous 90-volt connection on the receiving set, leave it as it is, and take an extra lead from this post to the B-positive post on the unit.

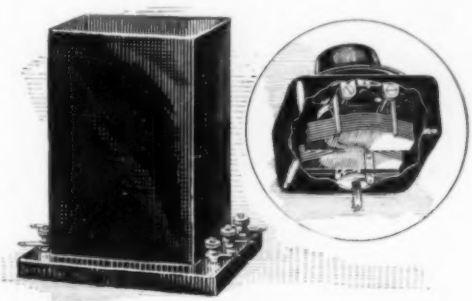
Connect the unit to the aerial and ground and to the aerial and ground posts on the receiver. Now the unit should be balanced. Light the tubes in both the unit and set, turning the tuning condenser of the unit to about 40. Increase the feedback, or volume control of the receiving set, until it oscillates, and tune the receiving set for a signal with its condenser. The signal will come in with the usual whistle; then turn the tuning condenser of the control unit for maximum volume. Vary the setting of the midget condenser until, when turning the tuning condenser of the control unit through the maximum volume of the signal, the whistle is varied in volume but not in pitch. Leave the midget condenser in this position. Tuning is then done with both the large condenser on the unit and the tuning controls on the receiver, adding selectivity and volume to the set.

Blueprints of the unit layout and wiring diagram, may be obtained from the Radio department, Popular Mechanics Magazine, 200 E. Ontario st., Chicago. Inclose 15 cents to cover postage and packing. Specify blueprint 109.

HOW TO PUT UP AN ATTIC AERIAL is the title of an informative article in the July, 1923, number of the magazine. This will be sent to any address upon receipt of 25 cents.

"Canned" Coils and Condensers

Shielded or "canned" coils and condensers are now on the market, saving

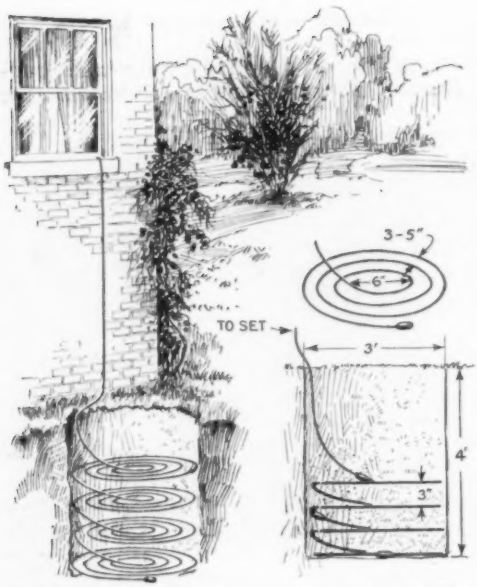


"Canned" Coil Reduces Pick-Up of Strong Local Stations; Insert, Details of Shielded Condenser

the experimenter the trouble of building his own. By shielding the condenser, effects of hand capacity are practically eliminated, dust or other foreign particles cannot accumulate between the plates, interfering with the tuning of the set, and the condenser is protected against magnetic spraying from other instruments. "Canning" of the coils confines their fields and reduces the pick-up of strong local signals by the coils themselves, besides allowing more compact construction, and eliminating the usual critical angle necessary with other r.f. coils. These advantages are especially important when r.f. amplification is employed.

Compact Battery Eliminator

A compact A and B-eliminator is now available. Taps are provided for the various A and B-voltages and the unit is plugged into the 110-volt 60-cycle house-lighting circuit in the same manner as an electric iron, or any similar electrical device. The A-voltage taps are arranged so that tubes of the low or high filament voltage types can be used. When the instrument is connected to the set, the filament switch on the set is left turned on, and the entire installation is turned on and off with a push-pull switch on the front panel.



Details of Underground Antenna Installation, Showing the Method of Coiling Wire and Spacing Coils

Underground Antenna Improves Radio Reception

A specially designed underground antenna is claimed to eliminate all interference by using ground waves instead of the air waves because the former are believed to be practically free from atmospheric disturbances.

The installation of the ground antenna is very simple. The method shown in the illustration was used by Popular Mechanics radio laboratory with good results and is specified by the manufacturer. The antenna consists of shielded and sheathed wire with especially constructed pick-up coils at the end and center, and is available in either 75 or 100-ft. lengths. The pick-up coils transfer the energy or ground waves by induction, and the sheathing transfers its pick-up of energy by capacity, the shielded lead-in acting as a return for strays.

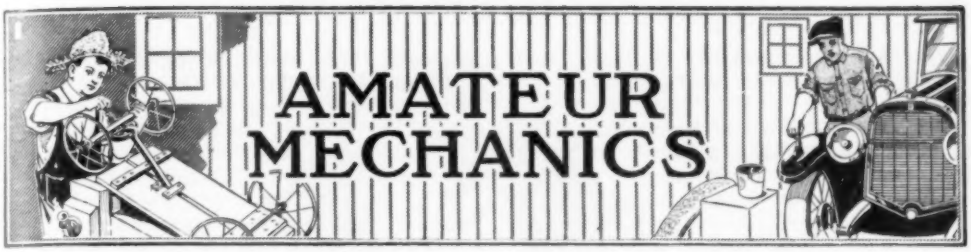
Locate a suitable spot of ground under the window nearest the radio set, and dig a hole 3 ft. or more deep, 2½ to 3 ft. in diameter. Start with the knob end of the antenna, winding in a clockwise direction to form a flat spiral coil. Working toward the center, keep the turns about 1 in. apart, until the space left in the center is about 6 in. across, as shown in the upper diagram. Cover this coil with about 3 in. of dirt, carrying the wire in a long sweep through this dirt to the side of the hole again; then lay another coil and cover it in the same manner, continuing until four coils are made as shown. The 75-ft. length will leave a balance to be used as a lead-in. Five or six coils can be wound with the 100-ft. antenna. If the cellar floor is not cemented the installation can be made in the basement.

There are two other methods of installing this type of antenna, one, in a straight-line trench from 18 in. to 2 ft. deep, and another in a trench of the same depth, but in the shape of the letter "S." The method illustrated is best, however, as the spiral form is non-directional.

New Dial Gives Readings in Wavelengths

A new dial for locating stations by wavelength readings as well as the usual method is now available. The dial is calibrated both ways from zero, so that either right or left-hand condensers can be used. This reading is shown through the window at the upper edge of the dial; the wavelength divisions are shown on the chart at front, and an adjustable pointer, which can be set to indicate the various wavelengths, also turns with the condenser shaft. An accurate wavelength reading on the chart can be obtained if the condenser and coil used are of suitable types; if not, the chart can be reversed, offering a blank surface for calibration for the condensers and coils used. If desired, the call letters of the stations can be inscribed on the chart. If the coil and condenser specified by the maker are used, a station is tuned in with the condenser plates about halfway out, the wavelength of the station is then looked up, and the large pointer is adjusted with a setscrew to that wavelength on the chart; the straight-line wavelength condenser will then show the corresponding wavelength on the chart.

¶A standard 50-ohm resistance coil, originally supplied with a bulb charger for charging B-batteries, when connected in series with a neutrodyne receiver and a 100-volt storage battery, has been found by a reader to produce increased volume and purer tone.



Cigar Humidor from Dime-Store Parts

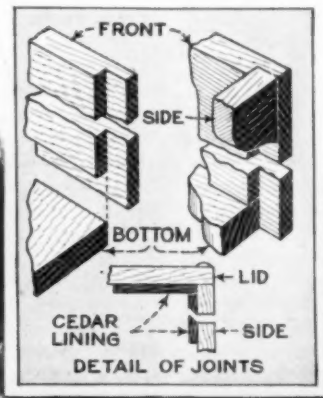
By J. EARLE MILLER

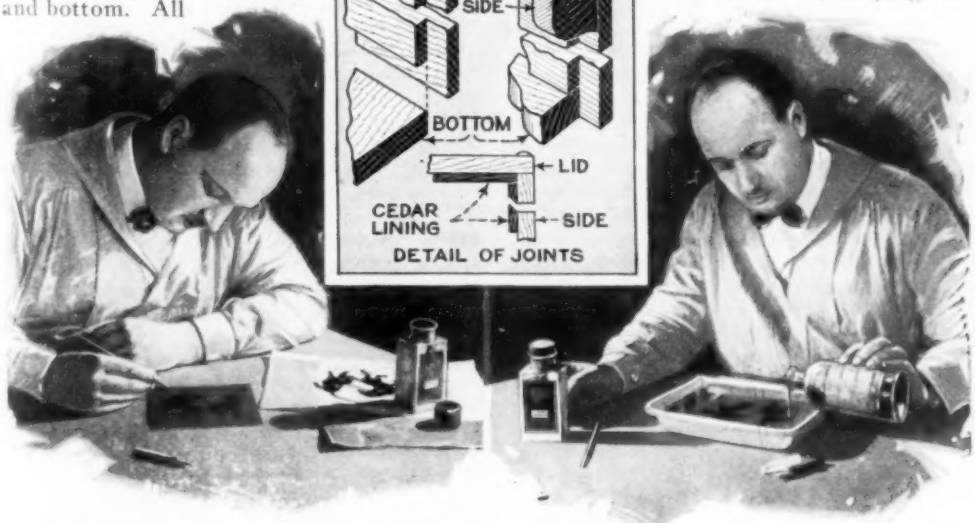
A CIGAR humidor, built, with the exception of the cedar lining and a small piece of brass, from parts purchased in a ten-cent store, offers an attractive and easily made ornament for the amateur whose tools and working space are limited.

Even the oak for the box was obtained, ready planed, from the dime store by purchasing parts for the knockdown radio cabinets sold there, and resawing them to the required dimensions. The actual size of the box was dictated more or less by the size of the radio-cabinet parts, but with an inside depth of 4½ in., a length of 8 in. and a breadth inside of 4 13/16 in., it is large enough to take 100 average-size cigars.

Fitting and assembling are simplified by building the box as one solid unit, and then sawing it apart to form the bottom and lid sections. The radio cabinet parts furnished two pieces, 9⅛ by 5 1/16 in., for the front and back, and two pieces, 9⅛ by 6⅛ in., for top and bottom. All the parts were ⅜ in. thick. Both ends and the bottom of the front board are rabbeted to a depth of ½ in., ⅜ in. wide, to take the ends and bottom, and the back at the ends and lower edge to form a joint for the bottom. The top can be rabbeted all around, and fitted in the sides, but, as the joint will show in any case, this is not necessary. The rabbeting was done by sawing the back line to the proper depth with a small coping saw, and the joint then was cut out with a chisel.

With the six sides completed, the parts were assembled with 5/8-in. round-head brass screws, and the corners, of brass, also from the ten-cent store, attached with similar screws, ¼ in. long. After the assembly is completed, mark a line around the box 1½ in. below the top, and saw it apart on this line. If large-size brass corners are used, with 1 13/16-in. sides, it will be necessary to cut them down with snips and file to clear the cut mark, shaping the

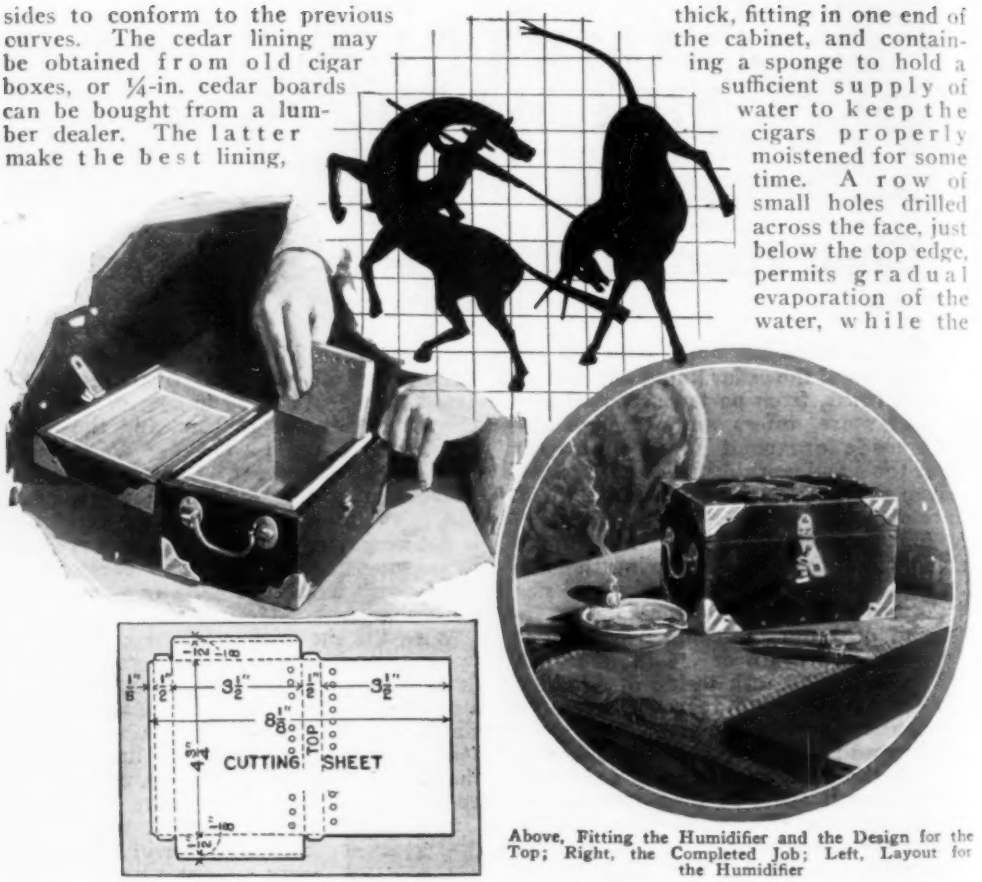




Left, Painting the Design with Asphaltum Varnish; Right, Etching the Plate; Center, Details of Humidor Construction

sides to conform to the previous curves. The cedar lining may be obtained from old cigar boxes, or ¼-in. cedar boards can be bought from a lumber dealer. The latter make the best lining, since few real cedar cigar boxes are available these days. Cut two pieces, 5⅜ by 8½ in., for the top and bottom of the lining and drop them into place. It is not necessary to fasten either. The sides of the lower part of the box lining are cut ¼ in. higher than the outer box, and fitted together with mitered corners, while the projecting ¼ in. is beveled off, sloping from the inside edge down to the sides of the outer box. The sidepieces for the lid lining are cut ⅞ in. wide, also fitted together with mitered corners, and the lower edges are beveled with an inward slope, so that when the lid is closed, they will form a perfect joint with the bevel of the lower part. This offset joint produces an efficient protection against rapid drying of the cigars.

If the corner joints are properly fitted, it will not be necessary to nail the lining of the lower part of the box. The sides of the lid lining, however, should be fastened with small brads. The humidifier comes next. It is a copper box, ½ in. thick, fitting in one end of the cabinet, and containing a sponge to hold a sufficient supply of water to keep the cigars properly moistened for some time. A row of small holes drilled across the face, just below the top edge, permits gradual evaporation of the water, while the sponge may be remoistened by dipping the copper box containing it in a basin of water, and, after the sponge is filled, allowing the excess to run out of the holes. The sponge container is cut from a single sheet of copper, as shown in the detail drawing, and is then bent and soldered together. The small ⅛-in. flaps give it additional rigidity and simplify soldering.



Above, Fitting the Humidifier and the Design for the Top; Right, the Completed Job; Left, Layout for the Humidifier

The next step is to finish the cabinet. For this, the corner pieces and most of the screws may be removed and laid aside. Then stain the outside with black oil stain, give it two coats of shellac, sanding each one, and a coat of good varnish, following which it is waxed. The screws left in during the finishing process, to hold the box together, may then be taken out and cleaned, or discarded for new ones.

The handles and latch, also from ten-cent store hardware counters, are added, the corners and other screws restored, and the humidor is complete, with the exception of the cover ornament—a picador on his horse and a bull in action. It is cut

from a sheet of 18-gauge sheet brass by etching away the surplus metal with a solution of one part nitric acid and two parts water. The design is so arranged that the picador's lance and the tail of his horse, sweeping back between the bull's horns, tie it together as one unit.

The materials needed include a sheet of 18-gauge brass, 5 by 6 in., a small can of asphaltum varnish, sold in most paint stores, a fine-tipped brush, twenty cents' worth of chemically pure nitric acid, and a glass tray or dish, large enough to hold the plate. One of the waterproof fiber trays used by photographers will do, since the paraffin coating will resist the acid.

Clean one surface of the brass and, with a sheet of carbon paper, transfer the design to it. Next paint over that portion which is to be preserved with the asphaltum paint, as shown in the photograph, taking care to get the edges smooth, and such thin parts as the lance, tail and horns about 1/16 in. wider than they will be in the finished piece. This extra width, which has been added to the design, will offset the sideward eating of the acid. This precaution is important. After the paint has dried, coat the entire back surface and edges of the brass, so that the acid cannot attack the metal from beneath, and set the brass aside for twenty-four hours until the paint is perfectly dry.

Mix the nitric acid with two parts of water, being sure to pour the acid into the water, and not the water into the acid, as the latter method is apt to result in splashing and painful burns, or damage to the clothes. Lay the brass sheet in the tray and cover it with the acid solution. Within a few seconds bubbles will begin to appear. Watch the solution carefully, and if it starts to boil rapidly or give off thick greenish-brown fumes, add more water carefully until the process has been slowed down to slight bubbling. As the acid eats into the brass, the metal dissolved in it will gradually form greenish copper nitrate, turning later to blue as the amount of dissolved copper increases. The same acid can be used several times, however, until it has reached a very deep blue. Eventually it will be "killed" by the dilution with metal salts, but a single mixture is sufficient to etch several such plates as the one needed.

From time to time the work should be removed from the bath and examined carefully to see that the paint is holding and to gauge the progress of the etching. Use a pair of pliers to pick up the brass. The acid will not harm them beyond depositing a coating of copper, which may be washed off with water. In case any of the acid is splashed on the skin or clothes, wash the affected part immediately in water, preferably with a little ammonia in it.

If the acid is permitted to bubble too fast, the gas released, getting under the edges of the paint, will lift it free and permit the nitric solution to attack the design. If that happens, wash off the work with water, dry it, and then repaint. Proceeding slowly, it may take four or five hours to eat away all the surplus metal, but slowness is better than too much haste, which either will spoil the work, or cause a 24-hour delay while a new coat of paint is drying.

When the etching process is completed, the paint is removed with turpentine and the edges of the work smoothed down with a small file. The surface is then polished with pumice stone and water, two holes drilled to take the screws, and the plate is ready to be mounted. The brass corners, handles and latch are likewise cleaned with pumice, and all the brass work lacquered to preserve the finish.

Leaky Roofs

Although the roof had been reshingled lately, a small leak occurred. Being unable to locate the leak myself and after two roof contractors had assured me that it was "fixed this time," the next rain proved the contrary. Climbing into the attic, I located the point where the water ran down a rafter and from there fell to the ceiling. I came to the conclusion that tar-paper drip pans placed directly beneath this rafter would remedy the trouble. I made them of different lengths and widths and about 4 in. deep. By folding them over at the corners and fastening these with a copper rivet, the trays are complete as the photo shows. It is not necessary to empty the trays even after a heavy rain, as only an inch or so of water will collect in a tray, and this soon evaporates, thus also keeping the attic less hot.—Frederick Boesser, Arlington, N. J.

Tar-Paper Trays Set under Drip Remedy Trouble of Leaky Roof

Improvised Garden Tool

Every farm has old pitchforks that have been discarded on account of broken handles. The ambitious farm lad can make them into useful garden tools. The sketch shows how a fork was converted into a garden cultivator. A hole, a trifle smaller than the shank on the tines, was drilled at an angle in the end of a 1½-in. stick. The shank of the tines was forced into the hole in the handle. A drawknife was used to take off the edges of the handle to make the tool easy to hold. It is very useful for cultivating onions, carrots and other similar garden truck.

Patching a Slate Roof

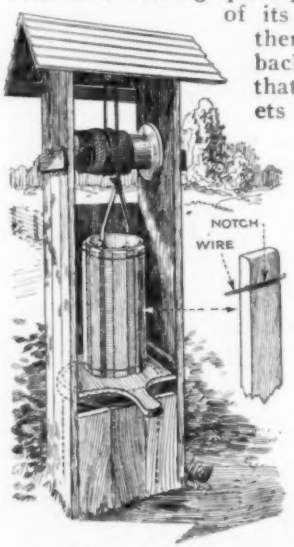
When a slate roof starts to leak because some of the units have come out where nails have rusted away, the home owner usually makes a repair by using piece of galvanized or black sheet iron and shoving these up under the slates. This makes a bright spot on the roof, emphasizing the fact that a slate is missing. The iron soon starts to rust and then disfigures the roof still more. Sheet lead on the other hand soon turns as black as the slate, and being thicker than the iron pieces, will be held more securely by the upper slates and will last for many years. Ordinary thin wood shingles, cut to the proper size and colored the same tint as the slate make a much better repair than sheet iron. The inexperienced man who attempts to punch holes in attached roof slate usually succeeds in cracking it and thus makes a bad matter worse. If a very sharp tempered steel tool is used to punch the nail holes by striking the head of the tool a sharp blow with a hammer, the slate will not crack and a clean-cut nail hole will be made. If a drill or soft-metal punch is used the slate will be cracked across or split into thin flakes. If care is taken to raise the edges of attached slates just enough to allow the entrance of a thin colored or stained wood shingle, the patch will not be noticed at a casual glance, and the shingle will be held in place by the upper slates for years, although it is not nailed.

Substitute for Ferrotype Sheets

Glossy prints may be made on the window panes in an emergency where the regular ferrotype sheets and accessories are not available. The glass is prepared by first daubing it with a solution of paraffin in benzine, and then briskly polishing it with flannel. The wet prints are stuck to the pane, the excess water is rolled out with a pencil, and the print is then left to dry. Prints made in this manner are remarkably free from the minute cracks that are often present in those that have been ferrotyped on old or defective sheets.—W. Eidman, Cleveland, Ohio.

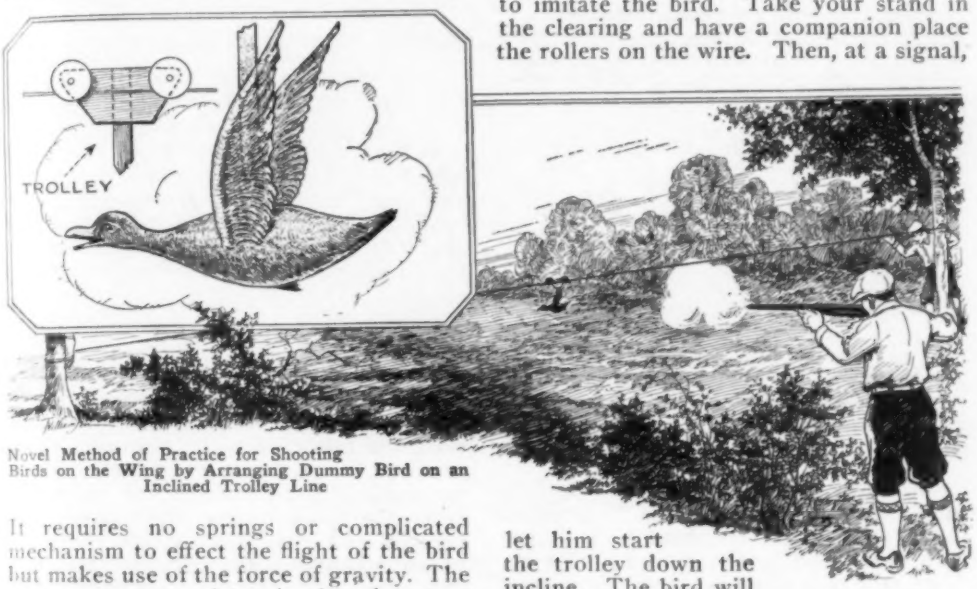
Protecting Well Buckets

Terra cotta or tile for tubing in drilled wells is becoming quite popular because of its durability, but there is one drawback to its use in that metallic buckets wear out too rapidly due to friction against the walls. A farmer eliminated this wear by applying a jacket of small hardwood strips to the bucket as shown in the drawing. Several strips are cut the same length as the bucket, and notched across the width about an inch from each end. They are placed all around the bucket and bound tightly to it with two strands of telephone wire. The wire is below the surface of the wood and cannot come in contact with the tubing, and the strips receive the wear instead of the bucket. They can readily be renewed whenever necessary.—L. M. Jordan, Vredenburgh, Ala.



Moving Target for Wing Shooting

The drawing illustrates a novel moving target with which the aspiring marksman can practice shooting birds on the wing.

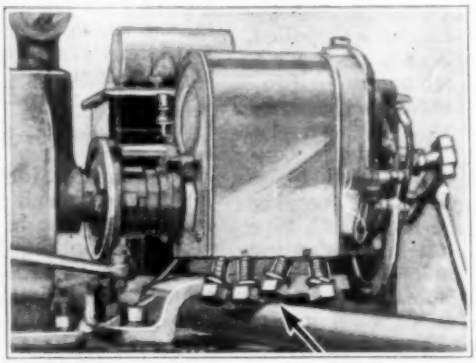


Novel Method of Practice for Shooting Birds on the Wing by Arranging Dummy Bird on an Inclined Trolley Line

It requires no springs or complicated mechanism to effect the flight of the bird but makes use of the force of gravity. The arrangement consists simply of a taut wire, a suitable running gear and a dummy bird cut out of wood or, better still, of metal. First choose the spot for your target practice, which should be an open space of ground secluded from passers-by and, if possible, with trees bordering it a hundred feet or more apart. Select two trees and stretch between them a length of stout wire without kinks or splices. One end should be as high as you can reach and the other end about 3 ft. from the ground. The trolley is easily made by cutting a piece of wood to the shape indicated, about 4 in. wide and 8 in. long on the top. Pivot a window weight wheel at each end, near the top, with screws so that the wheels can turn freely. Then, on the back side of the board, screw a strip of strap iron at right angles to the edge so that it will project below the wood about 1 ft. The bird should be large enough to form a fair-sized target. A goose is shown in the illustration, and was made out of hardwood. However, metal can be used, if desired, although it is harder to form for the amateur. Suspend it from the bottom of the strap iron, as shown, and paint it to imitate the bird. Take your stand in the clearing and have a companion place the rollers on the wire. Then, at a signal, let him start the trolley down the incline. The bird will gain speed on its flight and will offer a fine test for your skill in shooting on the wing. Arrange some bagging at the other tree to take up the shock when the bird hits it.—L. B. Robbins, Harwich, Mass.

Magneto Holds Loose Bolts

While making repairs and adjustments on a tractor, which requires the removal of small bolts, there is danger of having these mislaid and lost if they are merely placed on some surface of the machine, and especially if the work has to be performed out in the field, where a suitable box is not at hand. The photo shows how the parts may be placed on the base of the magneto and held there by the magnets. They cannot easily be brushed off from here and can be distributed so that their proper places may be known when replacing them.—George G. McVicker, North Bend, Nebr.



Using Tractor Magneto to Hold Loose Bolts While Making Repairs

Attaching Screen Tightly to Frames with Center Rails

Fastening screen to door and window frames, so that it is without wrinkles and

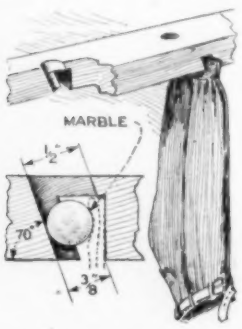
TACKING HERE PULLS WIRE TIGHT
WIRE TACKED HERE FIRST
WIRE GOES OVER MIDDLE RAIL WITHOUT CUTTING
WIRE TACKED HERE SECOND

Simple Method of Tacking Screen on Frames Tightly

loose places, can be done easily by the simple method shown in the illustration. Cut a piece of screen about 6 in. longer than the whole opening to be covered. Then tack it at one end, stretch it as well as possible by hand and tack at the other end. It will not be quite taut, but by tacking it down on both sides of the crosspiece, all sag will be taken out. The screen can now be tacked along the sides without difficulty, and the surplus at one end cut off with an old file sharpened to a knife-edge.

Hanger for Clothes Closet Saves Space

In closets where space is limited, the novel clothes hanger shown in the illustration will be found useful. A length of 1 by 3-in. stock is obtained and ½-in. holes drilled, 8 in. apart, about halfway through the wood at a 70° angle. The hole is continued with a ⅜-in. drill, keeping in line with the left-hand slanting side of the ½-in. hole. Then a slot is sawed in the board, slanting through the middle of the smaller hole and straight on the opposite side, as shown in the cross-sectional view.



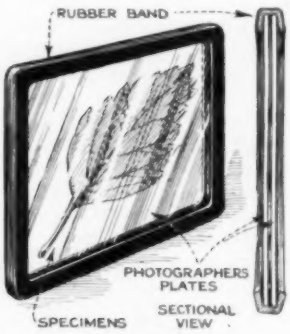
Marbles, which just fit in the ½-in. hole, are dropped in at the top. They cannot fall out through the ⅜-in. hole but stop near the bottom binding against and holding the clothing.

Keeping Handles on Sharp-Edged Tools

Handles often come off chisels, gouges and other tools when using them. The following method will remedy the trouble. Mix 2 parts of wax, 2 parts of brick dust and 8 parts of rosin, heat the mixture and apply it to the inner surfaces of the tool handles, then immediately insert the shank of the tool. If this is done quickly, the shank will stick in the handle securely.

Preserving Botanical Specimens

Preservation of botanical specimens, such as leaves and flowers, by pressing them in books is rather unsatisfactory as they are apt to become damaged when removed for examination or study. A better method is to remove the specimens from the books after they have been pressed and dried, and place them between photographers' dry plates, from which the emulsion has been removed by washing them in a bath of strong lye solution. By snapping a wide rubber band around the plates, the specimen will be held in position for examination or tracing. A protecting frame is thus obtained which allows rough handling, and specimens can be piled upon one another without damage.



Preheater for Ford Inlet Manifold

A preheater for the inlet manifold on Ford cars, which will prove satisfactory even on low-grade gas, can be made simply by wrapping some stranded copper wire, of the kind used for radio aerials, around both inlet and exhaust manifolds, to bind them into one unit. The copper conducts the heat from the exhaust to the inlet manifold and helps vaporize the fuel. —G. E. McAllan, Millicent, Can.

The Tool Chest Open, with Trays and Drawer Compartment Removed, Showing the Astonishing Number of Tools Fitted in Small Space

An Apartment Tool Kit for Six Dollars

A HANDY fitted tool chest, providing a safe place not only for the tools needed for radio building and home repairs, but the screws, brads, bolts and nuts, as well as other small parts, can be built by the novice at home, and fitted at small cost, largely from tools found in the ten-cent stores. The chest itself is made from one of the small, light wood-and-steel-covered boxes sold in trunk stores and by many hardware dealers. It is built up of light wood, 5/16 in. thick, covered on the outside with thin metal, enameled in sage-green, and bound with brass corners, with trunk-style latches and lock to keep the contents secure.

The box used had inside dimensions of 7 by 16 in. and was 5⅞ in. deep. It came fitted with a full-length tray, with an inside depth of 1¾ in. The tray was cut in two sections, each 7 in. long, the center 2 in. of its original 16-in. length being discarded, and the open ends of the two sections were closed with strips of cigar-box wood, 1¾ by 6 in. The cleats on which the long tray had rested were removed, cut into 6½-in. lengths, and two of them renailed along the sides of the box, at one end, low enough to allow the two new trays, when nested one above the other, to rest on the cleats and come level with the top of the chest. That left a space 2⅛ in. deep, beneath the trays, for the longer tools in the bottom of the box. A 3-in. strip of ½-in. wide brass was bent to form an angle bar, and screwed to the back of the chest at the end of the two trays, to keep them from sliding sideways. The two trays were divided into small compartments for radio parts, solder and flux, and spare electric-light plugs and fuses, with a long narrow space in the upper one for extra coping-saw blades, small files and pencils, and another space for small dividers and calipers.

From the parts of several cigar boxes, a chest of three drawers, 6½ by 7 in. by 4¼ in. deep, was built to fit in the opposite end of the chest. The inside depth of the drawer chest was 3⅝ in., which was divided equally between the three drawers. These are fitted without slides, working back and forth on each other. The drawer fronts project at each end 3/16 in., to fit flush with the outside of the box, and the top edge of the top drawer and bottom edge of the lower drawer have similar projections. Each drawer was divided with partitions, cut from cigar boxes to form nine small compartments, 1⅞ by 2 in. by 1 in. deep. The 27 compartments of the three drawers take care of a wide range of small nails and brads, screws, machine screws, taps, picture nails,

and other articles. Cleats were nailed to the sides of the tool chest 1¼ in. above the bottom, to carry the drawers.

Between the drawers and trays, in the opposite end, there is a space 3 in. wide

Drawer Compartment and One Tray Removed from Chest, Showing How They Are Partitioned

the full depth of the box. As pliers are among the most used tools, two pairs, one with long noses and the other of the side-cutting type, were fitted to the back and front. The long-nosed pair, purchased first, rests in a V-shaped wooden sheath, cut from cigar-box wood, while the other, attached more hastily, has a leather sheath made from part of a discarded glove.

The lid fittings included others of the more often used tools. Two strips of bakelite, 4½ in. long, ¾ in. wide and ¼ in. thick, attached ½ in. apart, provide space for ten sizes of drills and a countersink. Two screwdrivers, a reamer with detachable handle, two sizes of flexible wrenches for radio nuts, a small steel hammer, a wood carvers' knife, and a folding footrule complete the lid fittings. They are held in place by leather strips and clips made from spare radio gridleak and resistor clips. The space beneath the drawers and trays was filled with an assortment of larger tools, including wood chisels from ⅛ to 1 in. in width, a small steel-framed coping saw and a larger saw, taking either wood or hacksaw blades, a tack hammer, two screwdrivers larger than those on the lid, several files, small tin snips, a small try-square and a machinists' square, several sizes of round, flat and triangular files, packages of extra coping and hacksaw blades, an assortment of extra drills, including all the odd numbers from 1 to 59, inclusive, and a small radio drill. A small block plane and a vise made to clamp on the edge of a table drop into place between the trays and drawers, along with such odds and ends as spools of wire.

The cutting tools—chisels and block plane and wood carvers' knife—the special saw which handles both wood and metal work, and the radio drill came from a hardware store. Everything else was picked up at the ten-cent store hardware counters, which kept the total cost to a very low figure. The chest itself was bought at a sale for $1.75, and when completely fitted the entire cost was slightly over $6.

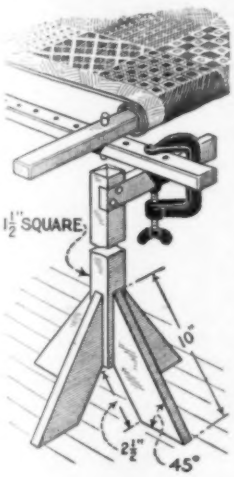
Chest Completely Fitted, with Block Plane and Calipers Lying on Drawer Top

Cleaning Suede Leather

Ladies purses, shoes, bookbindings, and other articles made of or trimmed with suede or "ooze" leather, get easily and quickly soiled and shabby-looking. The grime and dirt cause the rough surface to become black and shiny at points. Ordinary methods of cleaning are ineffective, but rubbing with a piece of fine sandpaper will restore the original appearance of the leather. This will raise the nap. The same method can be used for removing shine from clothing. —J. S. Hagans, Chicago, Ill.

Handy Quilt-Frame Props

The present fad for old-fashioned patchwork quilts is bringing the old quilting frames out of their dusty hiding places. There seem to be a few sets in every town that go the rounds of church-society quilting bees and do private service between times. In our society we have found that we must always count out four chairs with straight backs to hold up the frames, and this at such a height that those sewing on the quilt have to stand all the time. One of our number, whose husband is a carpenter, devised a set of props which made a hit with the whole society. They are very substantial, hold the quilt at such a height that those who work can be seated around the quilt with knees under it, and they not only allow four more chairs to be used for seating purposes, but the props are much more convenient to get around the corners. Four strips of pine, 1½ or 2 in. square and 25½ in. long, are cut exactly alike, and the edges are dressed to avoid slivers. Four base supports for each standard are cut from a 4-in. board, according to the dimensions given in the drawing. These supports add 2 in. to the height, making the total height 27½ in. Four arms are cut 6 in. long from a 1-in. strip of pine and one arm is attached to each upright in a horizontal position. The frames are easily held in place upon these arms by means of small C-clamps.—Mrs. Ruth Darling Shultis, Albion, Mich.

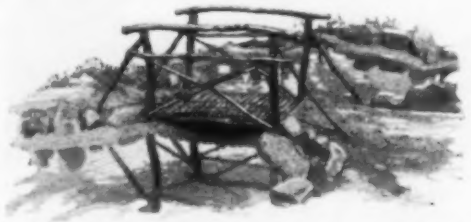


Chain Silences Rattling Keys

To avoid the rattling caused by a bunch of keys striking against the metal edge of the dashboard of an automobile, attach the ignition key to the ring with a 2½-in. length of light chain, incased in rubber tubing. This will effectively remedy the trouble. The chain should be long enough to permit the keys to hang ½ to ¾ in. below the lower edge. This will also prevent the keys from wearing the paint off a portion of the dash.

Improving Vacant Lots

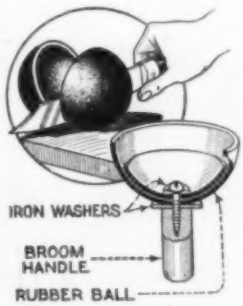
A home owner at Crete, Nebr., who had a vacant lot adjoining his place in the edge of town, recently turned this into a beautiful nook simply by digging a winding shallow pool, lining it with concrete and gravel and building a pretty rustic bridge on it as shown in the photo. The concrete was laid an inch thick and was placed over the entire surface and the shore was lined with crushed rock. In some cases concrete might be dispensed with by lining the pool with pure clay, and surfacing this with gravel or sand. Clay is almost waterproof and can be spread over a large area. If running water is available, a small stream can be permitted to run into the pool continuously. The photo was taken in early spring before vegetation had begun. The body of water is about 8 or 10 in. deep. If the pool is lined with concrete, a drain should be provided so that the water can be changed frequently during hot weather.—Dale R. Van Horn, Walton, Nebr.



Vacant Lot Improved by Artificial Pool with Rustic Bridge over It

Improvised Force Cup

Most people know the usefulness of a plumbers' force cup for cleaning out a clogged sink drain. When a regular force cup is not available, a good substitute can be made by cutting a hollow rubber ball in two, one part being cut slightly smaller than the other. Place the smaller part into the larger one and fasten both to the end of an old broom handle with a screw, the rubber being protected with iron washers, as shown in the accompanying drawing.—James Noble, Toronto, Can.



Exhaust Gases Cook Meals for Auto Tourists

A fireless cooker of a novel kind was cleverly arranged by a western tourist who recently took his family for an auto trip

Heat from Exhaust Pipe of Auto Cooks Meals for Tourists

to the Pacific coast. The cooker—of the so-called pressure type—was attached to the running board, and connected by a tube to the engine exhaust. Thus, all he had to do was put the food in the cooker and the hot exhaust gases did the rest.

Homemade Canteen

The illustration shows the construction of a canteen and a carrier that anyone who can handle a soldering iron can make at home. It is cheap, yet will serve the purpose as well as an expensive one, and the owner will have the satisfaction of knowing that he built it himself. Buy a couple of tin pie plates that have slightly rolled edges and are of the same size. Cut a small notch in the edge of each. Then place them together, notches meeting, and bind them in place with cord. Place in a vise and sweat solder completely around the circumference, making a water-tight joint. Cut out the screwcap from a polish can and enlarge the notches in the tins to correspond with its size and shape and solder this cap in the hole. This completes the canteen. The holder can be made from a section of inner tube. This should be shorter than the circumference of the canteen and should be split on the inside as shown. From a second tube cut a long piece for a carrying strap, then make a third loop of rubber to hold the ends of the slit tube fairly close together. Fasten the strap and loop to the tube with tire cement or by vulcanizing. The canteen is simply pushed down into the holder and the strap thrown over the shoulder in the usual way.—L. B. Robbins, Harwich, Massachusetts.

Unpainted Tool Handles Preferable

One frequently finds that handles of tools and implements used around the house have been painted to improve their appearance. This practice is, however, a poor one, as a coat of paint or varnish blisters the hand when using the tool, because of the greater friction between skin and paint. The tool handles should, therefore, be allowed to retain their natural finish.—A. C. Cole, Chicago, Ill.

Novel Doorstop

When visiting some friends I saw a novel doorstop. Instead of the usual carpet-covered brick or a leather bag full of sand, the weight was an ordinary rubber filled with lead. This can be made in the following way: Procure several pounds of sheet lead such as is used for wrapping tea; melt it to a running heat, then skim off the dross and pour the lead into the rubber. The hot lead will not injure the rubber, but as a precaution the overshoe may be placed in a pan containing cold water while pouring. After the lead has cooled, the exposed portion at the top is painted to match the rubber. When this stop is seen against a door the impression is that it is there by mistake, and one is inclined to push it aside or pick it up. If he yields to this impulse, the visitor will have a surprise and the host a laugh.—J. E. Noble, Toronto, Can.

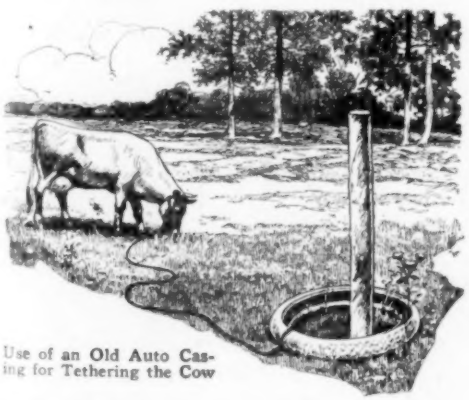
If you want to enamel your car and avoid streaks at the laps, add a little kerosene to the varnish; this will delay drying long enough to enable you to make a good joint with the first portion painted.

Repairing Grounded Timer Screw

Ford timers sometimes give trouble by grounding one of the contact screws on the shell. This causes a continual spark in that cylinder and the motor will kick and backfire. The coil is also likely to overheat. If a new timer cannot be obtained, remove the wire and nut from the grounded screw and pull off the washer. This may be cracked. If so, several thicknesses of paper, with a small hole through the center, can sometimes be used as a washer. Metal cuttings often cause trouble by lodging between the fiber ring and the shell of the timer about the contact screw. This is because of a shrunken fiber ring, and can, in some cases, be cleaned out by squirting gasoline about the screw. If this fails to remove the cuttings, the fiber ring and the contact screw must be removed from the timer, and the cuttings wiped out. Take care to replace the ring and screw with the same side in. A little shellac run between the fiber ring and the timer shell will keep out the cuttings for some time, and is worth trying if the timer is otherwise in good condition.—E. T. Gunderson, Humboldt, Iowa.

Tethering Cows

Tying and untying the tether rope is rather troublesome and can be eliminated by using the method shown in the illustration. The rope is tied to an old automobile casing, which is simply thrown over one of several posts driven into the ground in the grazing field. Another advantage of using this method is that the casing will roll around the post preventing the rope from winding around the pole

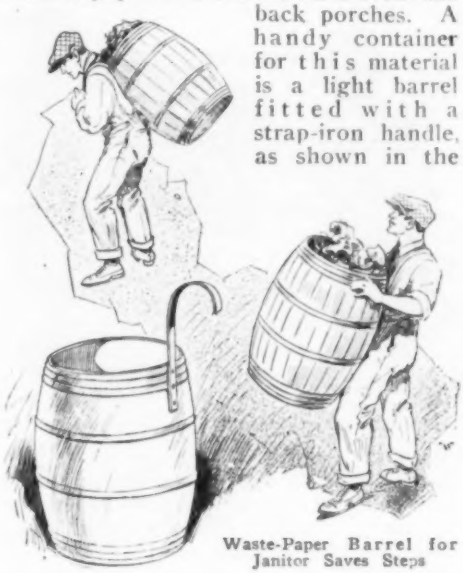


Use of an Old Auto Casing for Tethering the Cow

and thus bringing the cow close to it and decreasing her grazing area.—L. M. Jordan, Vredenburgh, Ala.

Janitor's Waste-Paper Barrel

One of the daily duties of the janitor of an apartment building is the collection of waste paper and other refuse from the back porches. A handy container for this material is a light barrel fitted with a strap-iron handle, as shown in the



Waste-Paper Barrel for Janitor Saves Steps

drawing. The handle is fastened on with bolts in the manner shown. The hook is made large enough to go over the worker's shoulder. The barrel can be carried on the back or on the chest as convenience and necessity may require.

Preventing Small Tractors from Overturning

Small, light tractors are frequently used for pulling stalled trucks out of ditches, or similar heavy work. For this they are quite efficient, but on a heavy, dead pull, they are apt to turn backward, and injure or kill the driver, the tendency to turn over being due to the action of the worm gear in the differential. To prevent such an accident, the tractor should be driven so as to face the truck to be pulled out, and should be hooked up in a reverse manner; that is, the chain should be fastened to the front of the tractor. The tractor should then be thrown in reverse and the truck pulled out by backing the tractor away from it.

According to a railroad paint chemist, one of the best formulas for making a paint for structural iron, such as bridges, is as follows: French yellow ocher in oil, 39 lb.; lampblack in oil, 1 lb.; raw linseed oil, 54 lb., and japan drier, 6 lb.

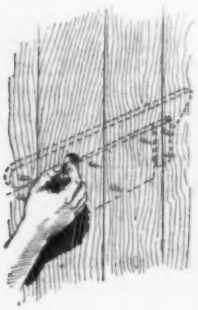
Removing Meat from Muskrat Skins

Trappers in the coast country near New Iberia, La., have found that a common clothes wringer is very handy for removing superfluous fat and meat from muskrat hides, and hence this familiar laundry appliance is part of the standard equipment of every trapper in that region. When the marsh inhabitants have skinned the trapped muskrats they turn to the clothes wringer for the next operation in the preparation of the pelt for the market. Inserting the muskrat skin, which is wrong side out and covered with fat and meat, into the clothes wringer, the pelt is run between the rubber rollers to come out clean with all the meat off. Grease "burns" a pelt, and must be removed to get top prices for the furs.

Hunters Use Clothes Wringer to Remove Meat from Muskrat Pelts

Secret Sliding-Door Latch

A farmer who was troubled by peddlers opening the sliding doors of his barns and outbuildings, devised the latch shown in the drawing, with which he effectively foiled all inquisitive persons. A slot, about 3 in. long and 1 in. wide, was cut through the door about 3 ft. from the floor and 2 ft. from the jamb. Thus it resembled the fingerhole common on barn doors with which they are opened. A latch, about 2 ft. 6 in. long, was cut from a strip of oak, and the narrow end pivoted to the door on the inside by means of a large screw. A block was fastened to the jamb for the latch to rest on, and a metal guide was provided to keep the latch close to the door. Finally a wide cleat was screwed to the door, covering all but about 1 in. at the top of the fingerhole, but leaving enough space under the latch to permit the insertion of a finger to lift it.



Renewing Window Shades

When window shades become faded or worn out at the bottom, they can be made to wear again by cutting them off the roll, tacking the bottom to the roll and hemming the other end, which then becomes the bottom. This is an efficient method of using curtains that would otherwise be discarded.—Charles Latour, Jr., Plattsburg, N. Y.

Drawer Pulls for Rustic Furniture

One of the difficulties that meets the maker of rustic furniture is to provide drawer pulls that will harmonize with the style. The various pulls that can be purchased in a hardware store will not fill the bill. I have tried knots of rope and whittled wooden handles, but nothing suited me entirely until I hit upon the idea of using pine cones, preferably the small hard ones of the lodge-pole or jack pine. If kept dry, they will never open. They are attached to the drawer by means of a 3/16-in. screen-door hook from which the hook end has been cut off. The remaining shank is threaded and attached to the drawer front by means of a small nut on the inside, while the screweye is driven into the pine cone. This forms a pendant pull of pleasing and harmonious effect.—Alfred Neuman, Troy, Mont.

Curved Printing Surface for Sharp Focus in Bromide Enlargements

Practically all of my negatives are of post-card size, and, in making bromide enlargements, I experienced difficulty in getting a satisfactory focus on 6 by 10-in. or 8 by 12-in. prints. When the center of the picture was in focus the outer portions were usually blurred, and vice versa

Compromising between the two gave unsatisfactory results. By providing a curved surface, on which the bromide paper is mounted, results were obtained that are satisfactory except for architectural subjects. A wooden box was made as long as the desired print and 1 in. wider. The height may be made as is convenient, but a height of about 2 in. is satisfactory. A partition was fitted into the box, dividing its length into two compartments. The upper edges of the center partition and the ends of the box were cut in the shape of an arc, the curve being determined by the distance from the lens to the easel when the center of the picture is in focus. The bromide paper is fitted to the curves on the box. The device is fitted to the easel by means of two strips fixed to the bottom of the box, and extending beyond its ends. The curved surface may be covered with cardboard to give a better backing for the bromide paper, which is held in place by pins or small tacks. If only a small part of the negative is to be enlarged, the flat surface is satisfactory.—Victor Woodland, Denver.

Edible Bird Houses

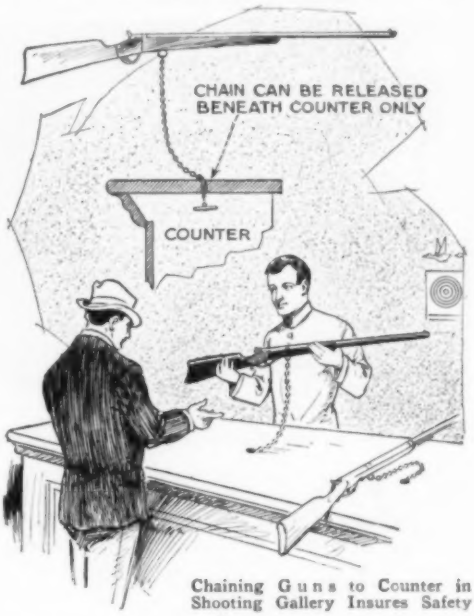
Unusual in construction and design, bird houses of edible material have been built by a Cincinnati woman in order to furnish birds and squirrels with food during the winter months, and the animals literally eat themselves out of house and home. The house proper consists of a 30-lb. cake of round crackling, which is pierced with doors and windows of decorative design. Rooms are dug out affording plenty of space. The roof and baseboard are heavily inlaid and coated with seed and broken grain, which is imbedded in lard. Squares of pumpernickel and grains of corn add a decorative touch.

Bird House Made of Edible Material Furnishes Shelter and Food

The dormers are filled with nuts.—L. R. Tichenor, Cincinnati, Ohio.

Safety Insurance for Shooting Gallery

Following the accidental discharge of a rifle in the hands of a reckless patron, which resulted in the shattering of a large window and some damage to a building across the street, the proprietor of a shooting gallery insured against a repetition by chaining the guns to the counter. The chains used for this purpose were long enough to permit the guns to be used freely for target shooting but could not be turned toward other patrons without some difficulty. The chains are slipped through a hole in the counter and a short crosspiece is fastened to the end of the chain as shown. The chain can be released beneath the counter only, when it is necessary to remove the gun for cleaning or repairs.—G. E. Hendrickson, Argyle, Wis.



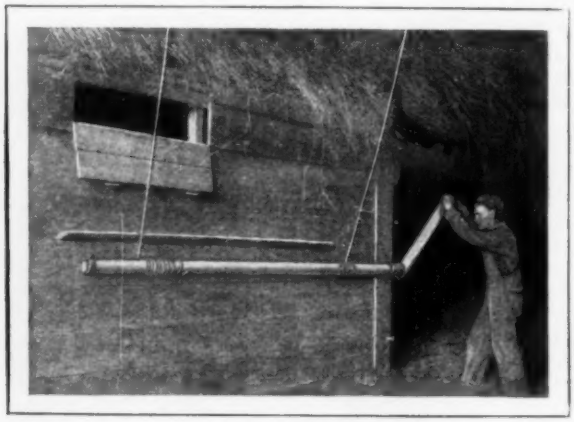
Chaining Guns to Counter in Shooting Gallery Insures Safety

Cleaning Greasy Dishes

Greasy dishes can be easily cleaned in the following way: A few pieces of gauze are sewed together to form a little sack, about 4 in. in length, which is filled with borax. The sack is closed on all sides and hot water is allowed to run on the bag for about a minute, while it is lying on a plate. By rubbing the plate with this bag, all traces of fat will disappear without soiling one's hands. —Frank Kaye, Brooklyn, N. Y.

Wagon-Bed Derrick

To avoid the strain of lifting a heavy wagon bed or hayrack by hand when he wishes to make a change from one to the other, an Indiana farmer has arranged a windlass on the side of his barn as shown in the photo. With this, it is easy to hoist the bed up under the barn roof where it hangs entirely out of the way and protected from the weather until needed again.—J. M. Collins, Kansas City, Mo.



Windlass on Side of Barn Is Used to Hoist Wagon Box

Writing on a Moving Train

Writing legibly on a fast-moving train is difficult to a person unaccustomed to it. The railroad conductor knows the trick of it and manages to get along quite satisfactorily. He prefers to write in a standing position and holds his right elbow firmly against his side. The reason for this is that in a sitting posture there is too much lateral movement in the trunk of the body, while in a standing position this is more easily controlled. When the arm swings freely, as in ordinary writing, several joints of the body are affected in the process, each of which is capable of its own motion. Holding the elbow against one's ribs "breaks" these motion tendencies, except that of the wrist, which movement is necessary in writing, and thus the pen is more easily controlled.

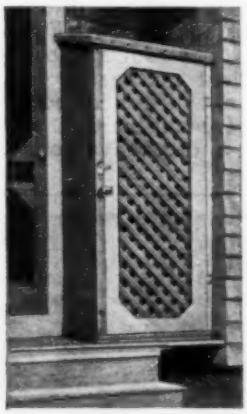
The same principles modified apply in using a typewriter on a moving train. Many traveling men, news correspondents, and others, carry portable typewriters and do much of their writing while traveling on trains, not to mention the various railroad and government men who travel in office cars and necessarily must get out their correspondence en route. It is extremely difficult to execute neat typewriting on a moving train with free-arm movement, even in the central portion of the coach. As I am employed in such capacity, I had to evolve a plan to expedite the work. I am able to do typewriting quite rapidly by resting the palm of the hands, near the wrists, against the front edge of the typewriter frame surrounding the keyboard, and using the swing of the fingers instead of that of the whole arm. —Victor Labadie, Dallas, Tex.

Retaining Wood Screws in Hardware

It is often desired to keep the wood screws used for attaching small hardware and automobile dash instruments with them. A good way to do this is to place the screws through the holes in the hardware and wrap a fine wire about the threads. The ends of the wire are twisted together, which prevents the screws from falling out.

Neat Ice-Box Inclosure

Many small homes have no provision made for housing the ice box, with the result that the kitchen is cramped for room or the box has to be put into the dining room or on the back porch, which is inconvenient and unsatisfactory. With this problem in mind, the owner of a small four-room bungalow built the special inclosure shown in the photo. A corner formed by a jog in the wall of the house formed two walls of the space. The outside was boarded in and an opening left in front into which was fitted a latticed door. The roof was given a good pitch and covered with heavy tar paper. About 2 ft. of space was left over the ice box so that the lid could be lifted, and a hole cut in the floor to permit the waste water to run out, a length of rubber hose being run through the hole and attached



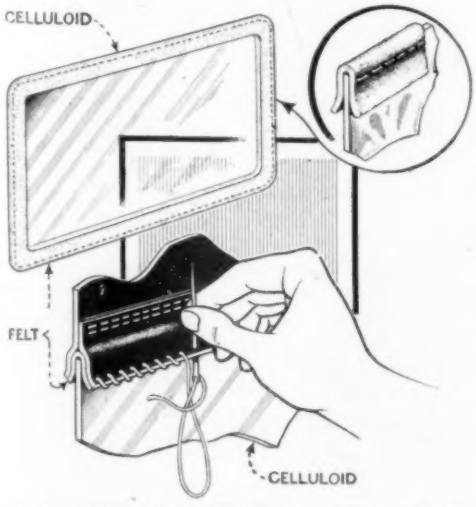
to the drain of the ice box. The lattice door was fitted with a spring latch and a padlock, and had a window shade inside, which could be drawn down in rainy weather to protect the finish on the box.

Keeping Rabbits from Fruit Trees

Coat the trunks of young apple and other fruit trees with the black, tarry paint that is supplied by manufacturers of roofing paper. It is applied with a brush. One liberal coating will last for years and will protect trees from the ravages of rabbits. At a Brushy Mountain orchard of 300 trees near Blacksbury, Va., such treatment was given 211 trees four years ago. Some of the other trees were wrapped, or coated with ordinary house paint. None of the properly painted trees have been molested, while the others have been gnawed more or less yearly. Girdled trees died and the growth of injured trees was stunted.—Dr. H. D. Ribble, Blacksbury, Va.

Replacing Auto-Curtain Lights

Sewing celluloid lights in auto curtains is a rather difficult task, as anyone who has tried it will admit. A good method, which is comparatively easy, is shown in the drawing. A strip of felt is first doubled and sewed to the edge of the celluloid

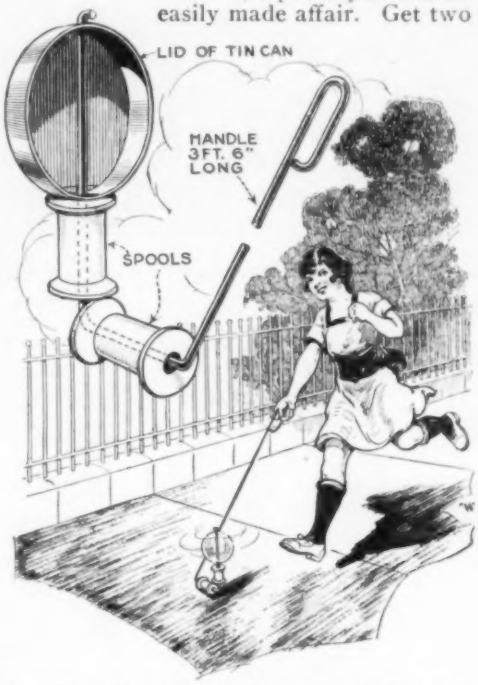


Quick and Easy Method of Sewing Celluloid Lights into the Auto Curtains

on a sewing machine and the felt can then be hand-stitched to the edge of the curtain as indicated in the lower detail.—G. A. Luers, Washington, D. C.

A Simple Push Toy

Novel toys are always of interest to children, and here is one that will appeal to them, especially as it is an easily made affair. Get two



Interesting Homemade Whirling Toy, Which Will Appeal to the Youngsters

old thread spools, a tin-can cover and a 3½-ft. length of No. 12 gauge galvanized-iron wire. The method of making the toy is clearly shown in the illustration, and in use it is pushed along on the sidewalk, which will cause the tin-can cover to rotate at high speed, the cover being nailed to the top of the upright spool.

Making Tight Pipe Joints

Lead filings sprinkled on the threads of pipe give a tighter joint than when ordinary white or red lead paste is used. The filings are made with a coarse rasp and are held in place by the cutting oil that remains on the threads. This method was given a thorough test along with methods commonly used, and it was found that, on ½-in. pipe, about half of the joints filled with lead paste leaked below a pressure of 8,500 lb. per square inch, one failing at 1,050-lb. pressure. A joint on which lead paste and lead filings were used leaked at 3,900-lb. pressure, while those on which only lead filings were used withstood the full pressure of 8,500 pounds.

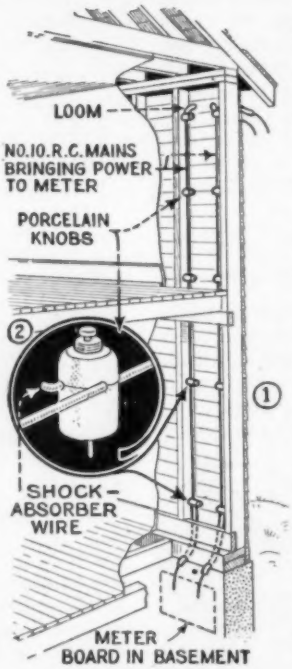
Wiring Your Home

By E. R. Haan

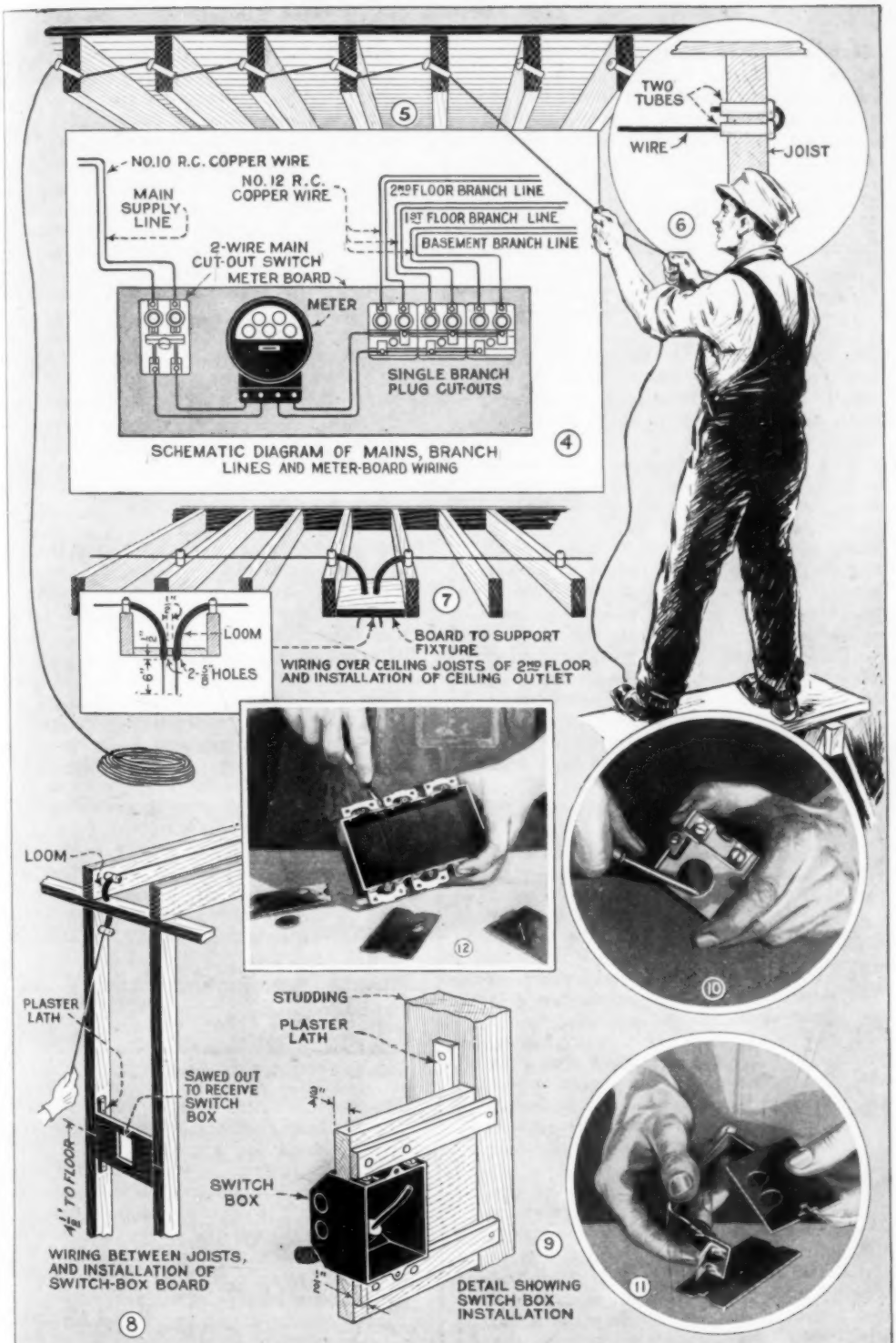
WIRING a house is usually considered the task of an expert electrician, but anyone who is able to grasp just a little theory and follow simple instructions as to the method of doing the work can easily wire his own home. The work of wiring a house is not advised, however, for home owners in the larger cities, where it is necessary that the work be done by a licensed electrician, but is especially recommended for the small-town home owner, and for the farmer. These may make a worthwhile saving by employing their spare time for this purpose. In this article the method of wiring houses under construction will be described, while sequent articles will contain information on wiring old houses, flexible metal-conduit work, fixture hanging, etc.

The first thing to do is to select the necessary tools. Those mostly employed by an electrician are a pair of wire cutters, a hammer and an auger. A pair of 6-in. side-cutting pliers will be found most convenient. A straight-claw hammer is highly preferable to an ordinary carpenters' hammer, as it is frequently necessary to remove porcelain knobs, boards, etc., for which the straight claw is particularly adapted. The handle should be cut short to make it handy for nailing between studdings, joists and rafters, which are usually spaced 16 in. center to center. A 5/8-in. auger is the most useful size on a wiring job. Get two or three of these, as they soon get dull and no time should be wasted on the job with a dull drill or in sharpening it. A ratchet brace or a corner brace is absolutely necessary. An ordinary brace cannot be used owing to the cramped quarters in which one must occasionally work. Next, get a couple of screwdrivers, one having a 2 or 3-in. shank and the other a 5-in. shank. A soldering iron and a blowtorch are also requisites for a wiring job, as every connection must be soldered as a precaution against fire and other troubles. The need for a small can of non-acid soldering flux, a pound or two of solid-wire solder, a roll of rubber tape and a roll of friction tape is obvious. A small keyhole saw is necessary for sawing out holes for flush-switch boxes, and a wood chisel will greatly facilitate this work. For sawing boards a small crosscut or panel saw is used.

Now the materials for the work have to be purchased. Perhaps you can make arrangements with the town

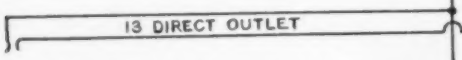


Installation of Main Supply Lines Running to Meter Board



Various Details of a Good Wiring Job Which Can Be Done by an Amateur, No Special Skill Being Required to Do This Work

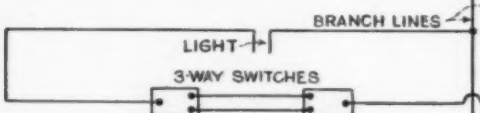
electric shop to return whatever wire, loom, knobs and tubes you may have left, as it is difficult to estimate the exact amount required. For an ordinary seven or eight-room house you should have a 500-ft. roll of No. 14 rubber-covered copper wire; about 200 ft. of No. 12 rubber-covered wire; 100 ft. of No. 10 rubber-covered wire; 50 ft. of "circular loom"; 200 porcelain knobs;



20 2½-in. porcelain tubes; as many flush-switch boxes as necessary; three double-pole, single-branch, plug cut-outs, and one two-wire main-panel cut-out with switch.

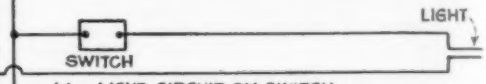
The proper time to wire a new house is just before lathing. Then the partitions will all be up, or should be, the preliminary plumbing work will be finished, the subfloors will be laid, and all the door and window jambs will be in place. The wiring has to be done at this time, and done as quickly as possible, or the lathers will be waiting. Under ordinary circumstances and if nothing untoward happens to interrupt the work, it will take the amateur electrician about two or three days to wire a one-family house of average size.

The "mains" are to be put in first.



15
3-WAY CIRCUIT FOR CONTROLLING ONE LIGHT FROM TWO SWITCHES

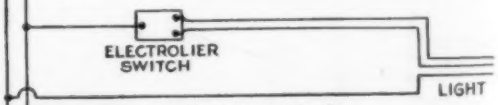
Their position is determined by the location of the nearest power-line pole in the street or alley. The mains should be brought out of the side of the house, preferably a few feet below the roof and at a point which is nearest to the city power lines. Drill two holes, about 12 in. apart, near studs as shown in Fig. 1. Now tie a weight to the end of the No. 10 rubber-covered wire, taking the end on the inside of the coil. Always follow this practice in unwinding a coil, as it will prevent getting the wire tangled. Drop the wire down the inside of the wall until the weight hits the first-floor sill. Then drill a hole through the sill and pull the wire into the basement where the meter board is to be installed. Do the same thing with the other main wire. In some cases it is desired to have the meter on the porch. A similar procedure is then followed, taking care never to cross a joist, sill or studding, but to go through it, pushing a porcelain tube or a length of loom through the hole before threading the wire through. A porcelain knob is nailed to the studding near the hole through the siding, and a length of loom, long enough to reach from the knob to about 4 in. outside of the wall, is slipped over the wire before it is pushed through the hole. Knobs should be located every 4 or 6 ft. apart, and the wire should be drawn taut before the



14 LIGHT CIRCUIT ON SWITCH

knobs are driven tight. A short length of wire in the empty groove on the knob, as shown in Fig. 2, will permit one to drive the nail down tight without danger of breaking the knob. Grasp the wire with one hand and pull it taut while driving the knob down as shown in Fig. 3. A good method of straightening wire before knobbing is shown in the headpiece.

After the two mains have been strung, two pairs of branch lines are installed. No. 12 wire is used for this purpose. These lines extend from the meter board up through the partitions and along the center of the ceilings of the first and second floors, from one side of the house to the opposite side, as shown diagrammatically in Fig. 4.

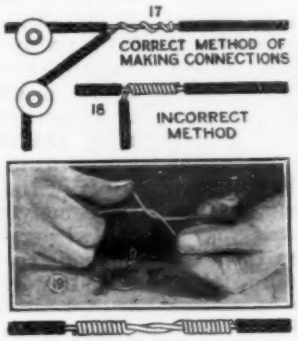


16 ELECTROLIER CIRCUIT

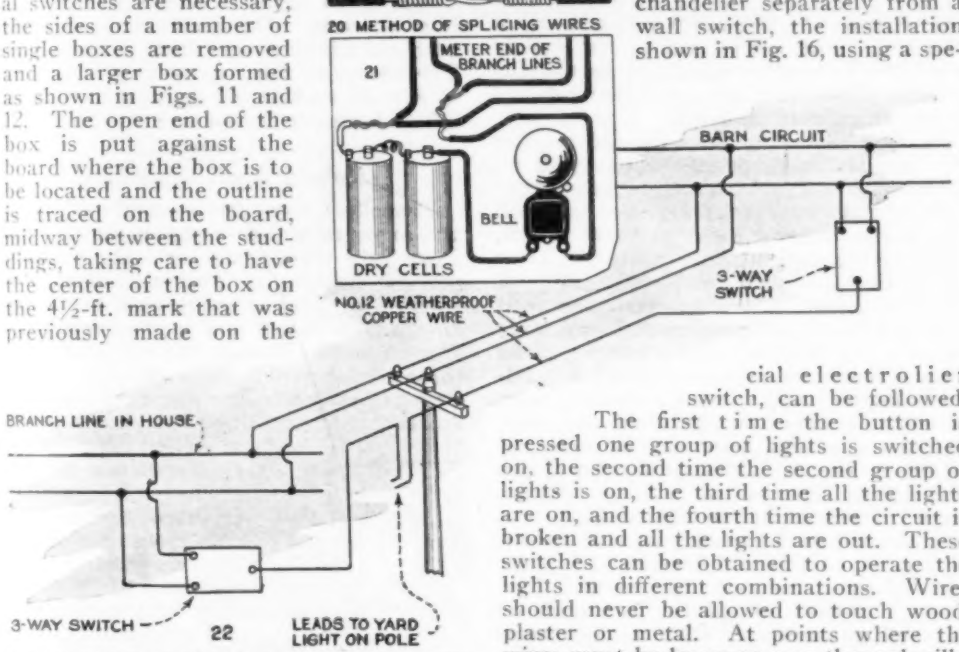
No switches are cut directly in the branch lines, but the wiring to the various rooms is tapped off at points most convenient. It will be found best practice to run the second-floor branch line first. Usually the wires can be strung right over the joists of the ceiling of the second floor, on knobs, instead of passing through them, which saves considerable time and expense.

Wherever outlets are to be located, a piece of ¾-in. board should be nailed between the joists, as shown in Fig. 7,

to support the fixture. The ceiling outlets are usually located in the center of the rooms. Wall lights should be about 6 ft. above the floor, switches about 4½ ft. from the floor, and the wall outlets, such as flush receptacles for cords, are located just above the baseboard. To be sure that all switch boxes are exactly the same height, take a stick, 4½ ft. long, set it up vertically and mark the joists, as shown in Fig. 8. This should be done before the board is nailed between them. Flush-switch boxes of the kind shown in Fig. 9 are used. Where several switches are necessary, the sides of a number of single boxes are removed and a larger box formed as shown in Figs. 11 and 12. The open end of the box is put against the board where the box is to be located and the outline is traced on the board, midway between the studdings, taking care to have the center of the box on the 4½-ft. mark that was previously made on the studdings. Drill holes at the corners and use the keyhole saw to cut out the hole. The clamps on the boxes are adjusted so that the boxes will project ½ in. beyond the face of the board, as shown in Fig. 9, which makes the edge of the box flush with the surface of the plaster. Before the box is fastened, the necessary holes are made for the wires by pushing out the perforated portions. Use the claw of the hammer to knock the perforated section inward and then bend it with a screwdriver until the piece breaks off as shown in Fig. 10. Lathing nails and lath are used to fasten the box to the supporting board, as shown in Fig. 9. This practice will prevent lathers from dislodging the box, which is otherwise easily done.



The coil of No. 14 wire is then untied and the circuits of the various rooms wired. Figs. 13, 14, 15 and 16 show the most common wiring diagrams. For hallways and large rooms, it is often desired to have two switches to control one light. The wiring is then done as shown in Fig. 15 and is called a "three-way" installation. Where it is desired to operate two or three lights on a chandelier separately from a wall switch, the installation shown in Fig. 16, using a special electrolier switch, can be followed.



Correct and Incorrect Method of Making Connections; Method of Testing the Circuits, and the Wiring of a Farm-Yard Light

The first time the button is pressed one group of lights is switched on, the second time the second group of lights is on, the third time all the lights are on, and the fourth time the circuit is broken and all the lights are out. These switches can be obtained to operate the lights in different combinations. Wires should never be allowed to touch wood, plaster or metal. At points where the wires must be loose or pass through sills, studdings, ceiling-outlet supports, or switch boxes, a length of loom should be used, fitting snugly between two knobs, as shown in Fig. 8, or from one knob to ½ in. outside of an outlet support or switch box, as shown in the detail of Figs. 7 and 9. Draw the ends of the wires to extend about 6 in. outside of an outlet and then twist the ends together to prevent them from being pushed back into the partition. Wires between knobs should always be pulled tight.

After the wiring of the second floor has been finished, proceed to string the branch wires for the first floor. In this

case all the overhead wiring has to pass between joists or through them. Get a masons' chalkline and mark the underside of the joists to facilitate drilling holes through them in a straight line for the branch wires, which should run parallel to each other and about 6 in. apart. Get a 2 by 10-in. board and improvise a scaffold directly under the position where the branch lines are to be strung. The height of the scaffold is adjusted to suit the worker. The holes are drilled about 2 in. from the lower edge of the joists and at an angle, as shown in Fig. 5, and porcelain tubes are pushed through from the highest ends of the holes, which will prevent them from slipping out; the wire is then pulled through. In doing this, the coil of wire should always be placed on the floor at one end of the line, so that the wire can be pulled up vertically from the coil. The inside end of the coil is used to prevent tangling, as mentioned before. The other end of the wire is anchored as shown in Fig. 6.

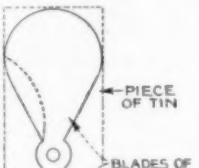
Instead of baring the wire and making the connections and splices as you go along, you will find it much more convenient and quicker to allow the ends of the wires to hang loose at these points, and do the splicing and soldering after the wiring has been completed. Peel off all the rubber insulation from the ends and portions to be connected and then scrape the surface of the copper clean with a knife to remove corrosion. Always support the wires with knobs near a splice, to take the strain off the wire, and make a neat open coil or twist, as shown in Fig. 17. This detail also shows the proper method of making connections. Never twist the bare end to form a close coil around another wire, as shown in Fig. 18, as this will prevent the solder from flowing between the turns. The correct method of splicing the ends of two wires together, with a few open turns, is shown in Figs. 19 and 20. After the soldering iron is heated, taking care not to get it too hot, tin it properly and proceed to apply solder to every connection. Apply flux to every connection first to make the solder stick. After soldering, apply the rubber tape and the friction tape to insulate the soldered portions.

The wiring of the basement can be done, on knobs, at any time later, provided the ceiling is not to be plastered. Otherwise the procedure already described for the first floor is followed. To test the wiring to be sure that it is correct, take two dry cells and connect them in series with a doorbell and to the branch wires, as shown in Fig. 21. Bring the ends of both wires of every direct outlet together, which should cause the bell to ring if the wiring is correct. If the bell does not ring, there is a break in the wiring at some connection, and this has to be found at once. On outlets operated by a switch, the ends of the wire at the switch have to be touching at the same time the wires of the lamp are touching, in order to close the circuit and ring the bell. On three-way circuits the ends of the wires in each switch box, and also the wires of the lamp outlet are connected in the same way to make the bell ring. After the wiring has been found to be correct, or made so, the preliminary work is completed and the lathing and plastering can be done.

Wiring in barns is very easy to do, as it is all open. On every farm equipped with electricity a yard light is necessary. The wiring to this light is done as shown in Fig. 22, so that it can be turned on or off at both the house and the barn.

Making Small Propellers

Propellers, used for a variety of model and experimental purposes, can be formed from light sheet metal with the aid of a pair of tinsnips or ordinary shears. A strip of material of the desired width and length is obtained and a circle is scribed at each end as shown. The points where these circles touch the long sides of the strip are connected by diagonal lines, the crossing point marking the center of the propeller. Two smaller circles are scribed around this center, representing the hub and mounting hole. The diagonal lines are now curved somewhat where they join the circles and one edge of each blade may be cut out as indicated by the dotted lines, which are arcs of a circle of a radius not too large in proportion to the length of the blade. Finally the blades are given a slight twist in opposite directions to make the propeller revolve in the wind.—J. S. Hagans, Chicago, Ill.



¶Small screws can be started easily in difficult places by putting a piece of gum on the end of a match and sticking the screw head to it.

Ridding Public Buildings of Flies

In many schools, stores, churches, and other public buildings, flies become a great nuisance during the summer season. If the building has a ventilating fan, it may be used to advantage to get rid of the flies. Drill a small hole in the side of the fan casing, large enough to admit the nozzle of a vaporizing pump. Shut all windows and doors in the room. Open the top ventilators and close the bottom ones. Now start the fan and fill pump with a good insecticide. Operate the pump and direct the vaporized liquid into the hole. The fan will blow the vapor all over the building and fill the rooms. Don't open the doors or windows for about an hour. This plan has been tried successfully in the local high school.—Wilfred Sorenson, Humboldt, Iowa.

Using Rope as Tire

In an emergency, when the autoist had no spare tire with him and did not wish to ruin the rim by running on it, he improvised a tire from a towrope, which he carried along. After the tire had been removed, the rope was wound around the rim, as shown in the drawing, so that it projected above the rim. Then a length of wire was twisted around both rim and rope to prevent its coming off. The car was driven for a considerable distance in this way without any damage to the rim.

Cleaning Zinc

There are many zinc articles used as kitchen fittings. To clean them, do not use the customary powders. A better way, and one that takes much less effort, is to use a cotton cloth dipped in kerosene. Rub the zinc well and then dry with a clean cloth of the same material. This method has been found very effective.

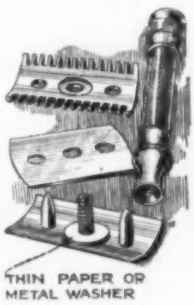
Seat Aids Gardener and Saves Space

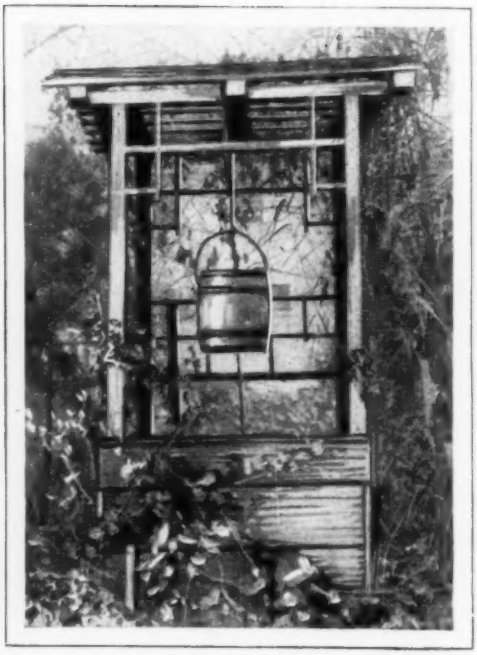
In order to have easy access to every row of plants a gardener made the seat shown in the photograph. It consists of a 12-in. plank with two heavy legs and slides, which are also made of 12-in. stock, to make it easier to shift the seat from row to row. Besides the ease of access gained, there is the additional advantage of being able to have the rows closer together, as space for working is unnecessary.—Frank Harazim, New York City.

Handy Seat for the Gardener Permits Him to Get At the Plants Easily and to Set the Rows Closer Together

Improving Old-Style Gillette Razor

If your old-style Gillette razor does not give satisfaction, do not discard it at once. A slight difference in the width of the blade causes it to lie very close to the safety guard, making it too rigid to cut the hair smoothly. Even new blades often seem to be dull. This condition is easily remedied by making the razor adjustable. Place one or two thin paper or metal washers around the middle peg of the razor before putting in the blade, as indicated in the drawing. This gives the blade less curvature and consequently removes the cutting edges a little from the guard, and a greater portion of the blade is free to vibrate, thus insuring greater flexibility and therefore a keener cut. Of course, it reduces the safety somewhat, as the cutting edges are farther away from the guard, but, with care to obtain the proper adjustment and if the razor is applied lightly, this method will give good results and prove beneficial to the skin.—Hatto Tappenbeck, Hollywood, Calif.





Quaint Old Well in Garden Is Both Attractive and Useful

Imitation Well House Is Ornamental Storage Place for Leaf Mold

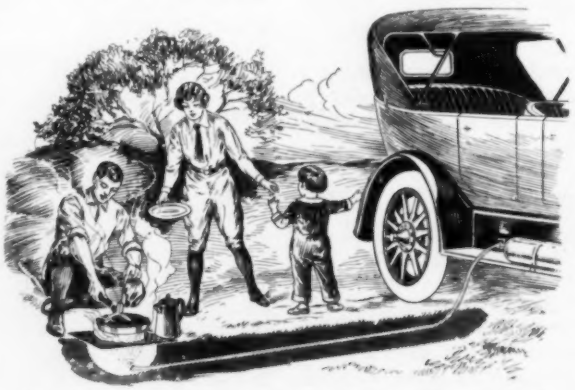
Aside from being ornamental, an imitation well house will be found useful in a modern garden as a handy receptacle for the storage of leaf mold—so necessary to the successful growing of plants. The house is easily built by the amateur carpenter. Four rough 2 by 3-in. redwood posts are set into the ground in a square measuring 3 ft. across. This space is next inclosed with rough 1-in. boards to the height of 2½ ft., making a roomy bin for the storage of leaves and rich dirt. The four posts are connected at the top with rough 2 by 3-in. stock and a roof is added, which consists of six pieces of 2 by 3-in. rough redwood, cut long enough to make overhanging eaves, each pair being joined in the center to form a ridge, 9 in. higher than the top of the framework, as shown. The roof is completed by nailing on 1 by ½-in. slats, spaced 2 in. apart. The bucket is a discarded paint bucket of oak and swings on a rope, which passes over a solid wooden wheel, nailed to a "drop" from the ridge, and is tied to one of the posts. In summer, vines may be trained to form a solid canopy over the roof and add to the attractiveness of the well house.—A. May Holaday, San Jose, California.

Eliminating Flat Spots in Painting

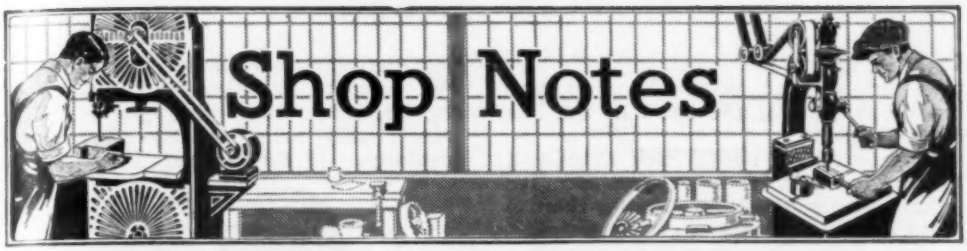
It is often rather discouraging for the amateur painter to try to eliminate flat spots, which will cause trouble if left alone, and it sometimes seems nearly impossible. A good, simple method is to apply a coat of linseed oil, brushing it in well to allow as much absorption as possible. Then allow a day or so to elapse before putting on another coat of paint over these spots.—L. H. Georger, Buffalo, New York.

Gas Stove for Campers and Tourists

Campers and tourists who travel where firewood or other fuel is not available can provide themselves with adequate means for preparing meals by carrying a tank of acetylene gas. The tank is mounted on the running board of the car and is provided with a 10-ft. length of rubber hose, which can be extended to reach the fire place of the improvised stove. When making camp, a shallow trench is dug from the car a distance of several feet and terminates in a hole somewhat smaller than the dimensions of the plate which is used to cover it. The hose is laid in the trench and covered, leaving the open end projecting into the larger excavation under the plate. The gas is turned on, making a blaze over which the cooking may be readily done. As long as the plate covers the hole completely, the gas will not ignite beneath it and the rubber hose will not be damaged by the heat.



Novel Method of Cooking with Use of an Acetylene-Gas Tank



All Shop Notes published in 1925, in book form—Fifty Cents—from our Book Department

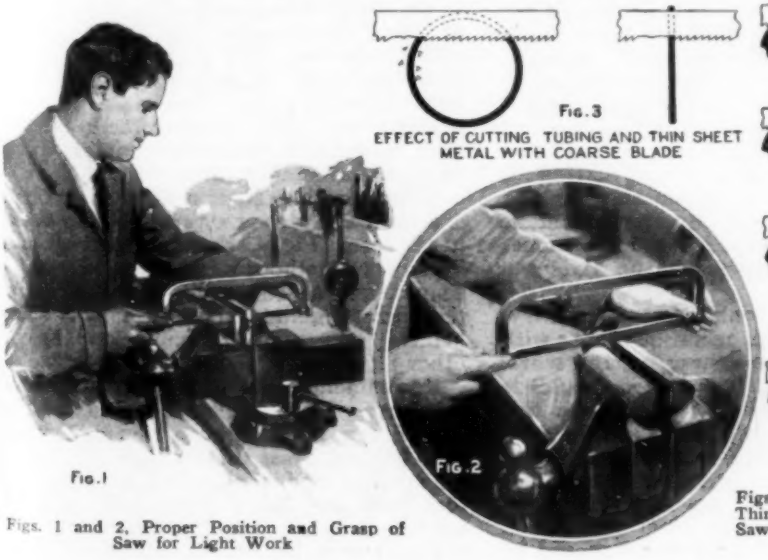
Getting Service from the Hacksaw

By JAMES TATE

BECAUSE the hacksaw is such a simple tool, there is a feeling that "anyone can use a hacksaw." While this is perfectly true, there is a great difference between merely using a tool and getting the utmost in service out of it, and even with such a simple tool as this, there is a right and a wrong way of handling it.

There are a few fundamental rules that are imperative, if the proper service is to be obtained from handsaw blades. First, having selected the proper blade, strain it well in the frame. This is important, to insure true cutting and to prevent breakage of blades. The saw is inserted in the frame with the teeth pointing away from the operator (this may seem foolish instruction, but I have seen them put in the other way), and the "hard edge" or flexible backsaw will be found to need greater tension in the frame than a blade of the "all-hard" type.

For light and medium work, stand at the vise and grasp the saw frame as shown in Fig. 1, with the forefinger of the right hand pointing along the handle of the frame in the direction of the cut, and holding the end of the frame between the thumb and first two fingers of the left hand (Fig. 2). Start the cut easily, using the same stroke as in filing, and be sure to put on enough pressure to make the teeth bite and not slide over the metal, as allowing the saw to rub over the metal on the start of the cut glazes the teeth and starts the saw on the road to the junk box. After the first few strokes retighten the saw in the frame. Lift the saw slightly on the return stroke so as to prevent the teeth from dragging or rubbing on the work, as any pressure on the return stroke also blunts the teeth. Keep the speed of the strokes to from 40 to 50 a minute, and the work will be cut more quickly and with less wear on the blade than if a faster stroke is used. Where a heavy pressure is required the end of the saw frame may be held as shown in Fig.



Figs. 1 and 2. Proper Position and Grasp of Saw for Light Work

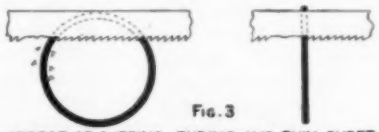


FIG. 3
EFFECT OF CUTTING TUBING AND THIN SHEET METAL WITH COARSE BLADE

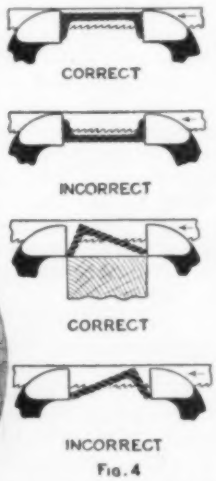


FIG. 4

Figs. 3 and 4, Effect of Thin Metal and Tubing on Saw, and Holding Work in the Vise

5, all the weight and pressure of the hand being transmitted to the blade through the fleshy part of the hand at the base of the thumb.

In most small shops each man owns his own frame, and there is comparatively little handsawing done; what there is, being on different materials from time to time as necessary in the course of assembly or erection of machinery. In this case, it is naturally impossible for the men to change blades to suit the material to be cut, and a blade is selected that will work fairly well on all material to be

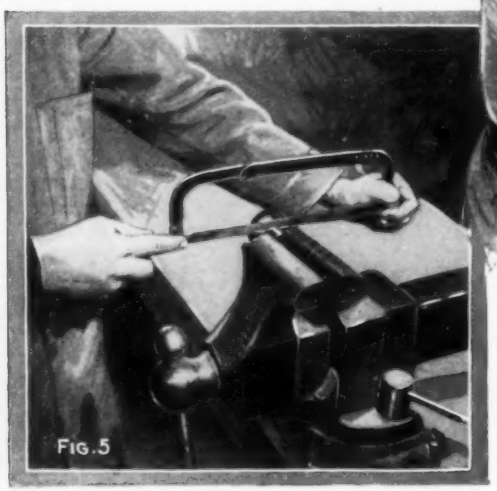


FIG. 5

handled; at least that is what should be done, although the men in the shop may be more or less at the mercy of the purchasing department. The blade selected is usually one with about 14 teeth to the inch, and this will work well on brass, cold-rolled steel, cast iron and tool steel. Even in the small shop, however, there is a decided advantage in supplying the men with a finer-tooth blade for work on thin sheet metal and tubing, one having 32 teeth to the inch being suitable for this purpose. It is an even greater advantage if the blades are kept in separate frames so that they can be picked up and used at once.

Most hacksaw troubles come from trying to cut thin sheet metal or tubing with a blade that is too coarse for the work. Fig. 3 shows what happens to the blade when a coarse-pitch saw is used for this work. For thin metal a blade should be selected having teeth so fine that two or more of them will engage the work at once. If the teeth "straddle" the metal, they will be stripped from the blade. Wherever possible sheet metal should be held between two pieces of wood, as in Fig. 6, when sawing it in the vise, and the cut taken right through wood and metal; this helps greatly in reducing breakage. If this is not possible, then

Fig. 5, Grasp of Saw for Heavy Pressure; Fig. 6, Sawing Thin Metal between Blocks; Fig. 7, Cutting Thin Metal to Avoid Saw-Tooth Breakage

FIG. 6

CUTTING SHEET METAL

FIG. 7

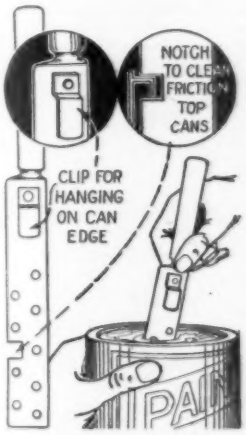
care should be taken to saw through the metal at an angle, as shown at B, Fig. 7. If the metal is so thin that, with the blade at hand, even cutting at an angle will allow only one tooth to bear on the cut at a time, then the sheet should be sawed flat, as shown at A. The main thing to observe is to have as many teeth as possible cutting at once; never less than two and preferably three.

When cutting structural shapes there is a right and wrong way of holding them in the vise. Fig. 4 shows the correct and incorrect methods for two common shapes, and a little study will show how the correct method makes it easy for the blade. The same principle applies to other shapes.

Recommendations of leading saw manufacturers, who have made a study of the art of saw cutting, are: For cast iron, solid babbitt, brass, copper, bronze, aluminum, cold-rolled stock, soft steel, annealed tool steel and heavy structural steel, 14 teeth to the inch; practice differs to some extent, one maker recommending 14 teeth

for solid cold-rolled machine steel, 18 teeth for tool steel, cast iron and brass; for light structural steel, tool steel and hard metals, one recommends 18 teeth and another 24. Both unite in recommending 24 teeth for steel pipe, iron pipe, brass and copper pipe, and conduit, and for thin sheet metals and tubing under 18-gauge, 32 teeth to the inch. Flexible-back saws are not recommended for use in tool steel, cast iron or brass by one maker, while another lists them for use in these metals. However, their recommendations are to be taken merely as a guide, or a basis on which to choose trial blades for any particular purpose, and they are very useful in this respect. In fact, it will pay any hacksaw user to get the literature of the saw manufacturers on this subject, as it contains much practical information on the subject of hand and power sawing as well as charts for saw selection.

Serviceable Metal Paint Paddle



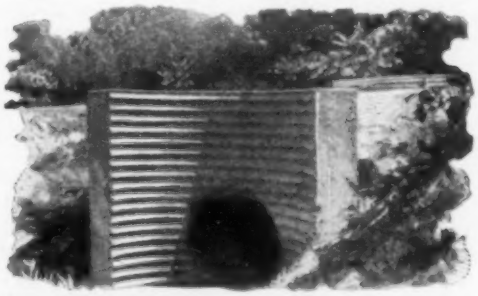
A cheap case-knife, with the end ground off and a clip riveted to the blade near the handle as shown in the illustration, makes an ideal paint paddle for the home workman. Holes drilled through the blade make stirring quicker, and if a notch is cut in one side with a file, any small trace of white lead or paint remaining under the rim of a friction-top can, can be easily scraped out. To facilitate cleaning, file down all the rough edges before using.

Cleaning Lantern Chimneys

In street work, where many oil lanterns are required for warning signals, the cleaning of smoky chimneys each day is a time-consuming task. A very convenient and efficient method of cleaning a chimney is to scoop in some dry sand until the chimney is half full; then, stopping both ends with the hands, shake it vigorously. The rock particles will scour off all the grime in a few moments.

Forms for Concrete Culverts

Forms for concrete end walls for small road culverts are easily made from a few sheets of corrugated-iron roofing. The

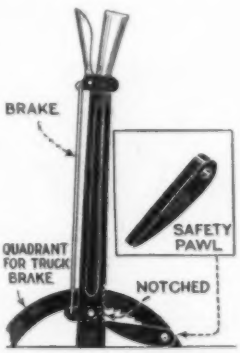


Forms on Ends of Concrete Culverts Made of Corrugated-Iron Roofing

ends of the sheets are nailed to a 2-in. plank wide enough to give the desired thickness to the wall. A hole is cut for the tile and the form is ready to be poured. The corrugations help strengthen the form so that less bracing is required; at the same time the sheet iron permits bending so as to make a semicircular wall if desired, a feature that would require considerable work if a wooden form were used. The form is light and easily handled, and the wavy surface adds to rather than detracts from the appearance of the finished wall.—M. W. Lowry, Athens, Ga.

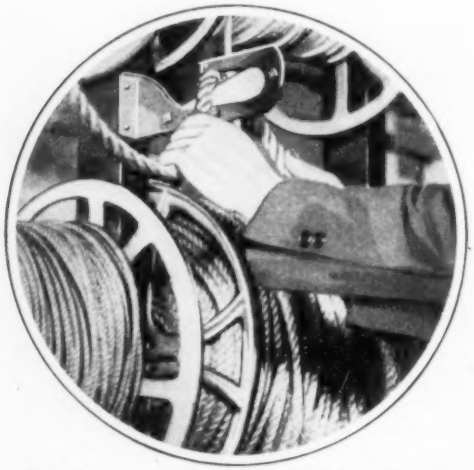
Safety Pawl on Truck Brakes

While playing in a truck, which was parked on a hillside, two small children released the brake, allowing the truck to run down the hill with considerable speed and resulting in a smash-up against a tree at the bottom. To prevent a similar accident, the driver put a safety pawl on the brake as shown in the illustration. This makes it impossible for a child to loosen the brake, as considerable force is necessary to pull it back to release the pawl. The front lower portion of the brake lever is notched as indicated, and the pawl is pivoted in front of it on the ratchet quadrant.—G. A. Luers, Washington, D. C.



Convenient Rope Cutter

One of the clerks in a San Francisco store has devised a very efficient cutter for rope. It consists of a sharp blade ar-

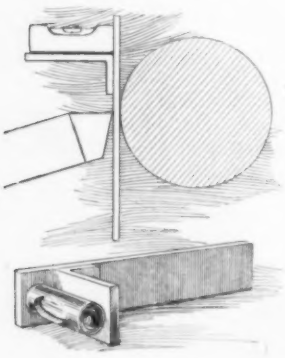


Metal Hook with Sharp Blade Cuts Rope Quickly

ranged on one side of a metal hook. By this means the heavy rope can be easily and quickly cut off by pulling it forward against the sharp blade, as shown in the accompanying photograph. — Charles W. Geiger, San Francisco, Calif.

Tool Setter for Lathe Work

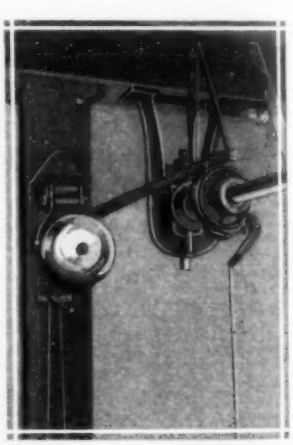
When cutting threads or turning tapers in the lathe, accurate work demands that the exact tip of the edge of the cutting tool be in the same horizontal plane as the lathe centers supporting the work.



To get this setting quickly and with accuracy, the tool setter shown in the drawing was devised. It consists of a rectangular strip of hard brass, to one end of which is attached a short angle strip. To the angle strip is sweated a length of brass tubing of sufficient size to admit a commercial level glass, with about 1/16 in. clearance. An angle block is carefully plumbed and the tool setter is clamped to it, plumb in both directions. A level glass is smeared with a little soft putty, put into the tube and adjusted until the bubble stands central. After the putty has set, the tube is closed up with more putty and the device is complete. In use, a preliminary cut is skimmed off the work to insure its being cylindrical and coaxial with the lathe centers. The tool setter is then placed between the work and the tool, and the latter adjusted. When the exact tip of the tool is dead on the center of the work, the tool setter will stand plumb, with the bubble in the center of the level. The device can be used on cylindrical grinders, thread millers, and like machines.— H. A. Freeman, Willimantic, Conn.

Stopping the Shaft Quickly

Shafting in long lines always carries many good-sized pulleys and the energy stored in these causes the shafts to run for considerable periods after the power has been cut off; longer, of course, when the shaft turns on anti-friction bearings and is well lined up. When a belt breaks or gets tangled up in another and goes thrashing around, there is urgent need of stopping the shaft before great damage is done, and when the accident involves a human being, there is all the more need for quickly stopping. One factory has installed the type of shaft brake shown in the photo. The couplings are of the type having smooth outer surfaces and a band brake has been installed on one near the motor driving the shaft. It is an automobile brake with the band altered to suit the coupling, securely mounted so that, normally, it is free from the coupling. But when one pulls on the handle of the rod, which is at a convenient height for applying the whole weight of the body, the brake takes a very effective hold. After shutting off the power, one shaft usually ran 40 seconds before it stopped, but with the brake, it was stopped in 10 seconds.

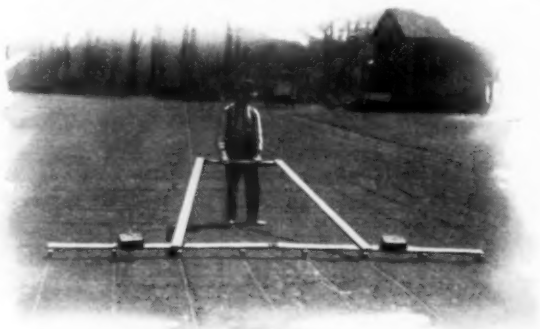


Stamping High-Speed Drills

Shanks of high-speed drills or end mills are often too hard to stamp after hardening, and if stamped before that process, the lettering may be ground off, as a high-speed mill or drill will bow toward the stamped side when hardened. We take the end mills, after they are hardened and ground on the shank, and give each shank a coat of etching varnish. When the varnish has dried right to be scratched, we place a piece of thin white paper on the shank and roll the stamp lightly over the paper just the same way as is done when stamping soft work, except that the paper is touched lightly over the hardened shank. The letters and figures on the stamp make the varnish on the shank stick to the paper, and strong muriatic acid is then applied to the bare surfaces where it etches the mark. If the paper sticks to the figures or letters on the shank, leave it alone, or apply a little wet acid, which will loosen it. Straight stamping will act the same way, but do not hit too hard. Place the pieces etched in hot soda water to neutralize the acid, and then wash off the varnish with benzine. The shanks can then be oiled. —W. L. Miles, Warren, R. I.

An Eight-Row Garden Marker

With the aid of the marker shown in the photograph the rows in large truck gardens can be marked accurately and quickly. It consists of a long board with pointed wooden pegs extending from the underside and a handle by which the device can be pulled. Bricks are tied on the marker to weight it down so that the pegs will make a deeper impression. As eight rows can be marked at once, the task of marking a large garden is considerably shortened.



Simple Homemade Garden Marker Which Marks Eight Rows at the Same Time

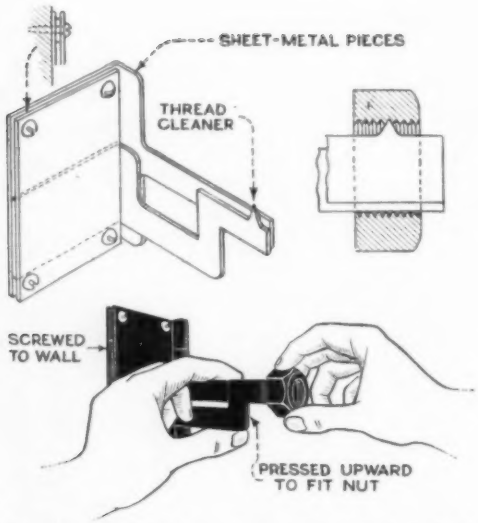
Carpet Bumper Protects Door Jambs

A western building-management firm recently offered a prize to any employe suggesting the most efficient means of protecting the highly polished mahogany door jambs while moving furniture in or out of the rooms. The prize-winning device was made of heavy carpet, 4 ft. long and wide enough to cover the jamb properly, as shown in the photo. Three strong spring-steel bands, heavily padded, served to attach the protector to the door jamb.

Filling Holes in Brass

Experimenters are often puzzled as to how they are going to get rid of holes in brass castings, etc., which are drilled in the wrong place or which become superfluous as the result of some change or improvement. The following method will do the trick: Fill the holes with solder to within 1/32 in. of the surface, then file a piece of brass of the same shade as the casting with a medium fine file, catching the filings on a piece of paper. Put the filings in a cup, pour killed muriatic acid over them and leave standing for a few minutes. Then sift them over the solder in the holes so that they can be seen to be a little higher than the surface. Heat is then applied until the solder runs and adheres to the filings. When cool, the surface is sandpapered smooth and polished. This idea works well also on copper or iron castings but not on aluminum. The acid is killed by dropping in some zinc stripped from old dry cells. Both the acid and the filings must be clean and free from other kinds of filings and dust. The holes to be filled must be perfectly clean and tinned right to the top.

¶Plaster of paris casts can be toughened by boiling in paraffin and polishing.



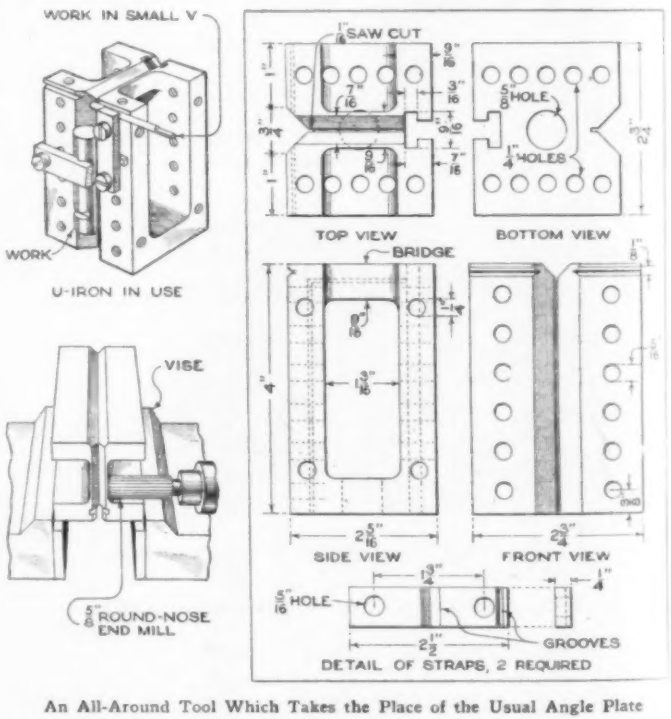
Scraping Out Threads of Secondhand Nuts Is a Quick and Easy Job with This Fixture

Cleaning Out Old Nuts

One of the hindrances to using secondhand nuts is the thick scale or hard paint, lead, etc., which often accumulates in the threads. Using a hand scraper to remove this takes too much time to make it profitable. However, anyone in charge of a small storeroom can make a handy fixture for this work that will do the job nicely in a minimum of time. The accompanying illustration shows the construction. Three pieces of sheet metal are used to make up the scraper. The piece nearest the wall is cut as indicated and bent at right angles; the second is cut somewhat differently, with a V-projection on the top. The third piece is a plain one which holds the completed device to the wall by means of four screws. The scraper here described was dimensioned to clean out any size of nut from ¾ in. up. To operate it, the projecting parts are pressed together until the "V" fits the threads and the nut is then turned to scrape out the dirt.—Harry Moore, Montreal, Can.

A Tool Makers' U-Iron

For taking the place of the ordinary angle plate, the U-iron illustrated will be found a valuable addition to the tool maker's equipment. A block of tool steel is used, which, after the machining operations are completed, is casehardened and ground to the finished dimensions. The block is milled out as shown, for the sake of lightness, with a round-nosed end mill. Turn the work to mill the various surfaces and do not upset the height of the table until you have gone all around the work. Allow 1/32 in. when taking the roughing cuts for finishing. V-slots for holding either square or circular work are machined at right angles to each other on the edge and top of the block, while a T-slot is milled into the opposite side for bolting the device to the bed of a machine. A third and smaller V-groove is cut at right angles to the one on the front face of the block, for holding work of small cross section. Bolt holes for the clamps are drilled and tapped in the stock at the sides of the several grooves and slots. Two strap clamps of the style illustrated will be needed and grooves are cut into one end and the middle, the better to conform to the work being held and minimize the possibility of its slipping.



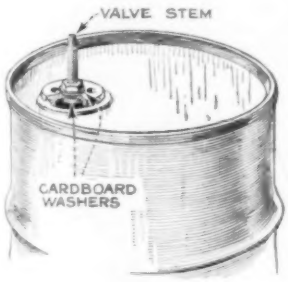
An All-Around Tool Which Takes the Place of the Usual Angle Plate

Crankcase Oil Keeps Mites Away

Poultrymen find it necessary to use some means of destroying red mites especially during the summer months. Formerly coal tar mixed with kerosene was used extensively, but the strong odor is rather objectionable in cities, although its use is permissible on the farm. Worn-out crankcase oil, applied liberally to all parts of the roosts and supports and also to the nest boxes, has been found to be an effective substitute. Only three applications have kept the mites down an entire season.—G. D. Willits, Adrian, Mich.

Saving Gasoline

Finding that our gasoline bill was rather high we started to investigate all possible causes of loss. A number of ways were found to make a gallon of gasoline last longer. Among other losses that were figured was the loss due to evaporation, which was surprisingly large. We had two 50-gal. tanks, each of which had a small hole in the cover to let in air when the gasoline was drained out. On a warm day one could easily smell the gas as it escaped through the holes. The condition could not be bettered by making the holes smaller as this hindered the flow of gasoline. The caps were removed and the air holes drilled large enough to receive the valve stem of an old inner tube. Cardboard washers were placed on both sides of the cap and the nut screwed down tightly. No gas can now escape, as the valve remains closed until gasoline is being drained out, when it is opened to let in air.—Jonas J. Byberg, Silverton, Oreg.



Clipping Horses

By clipping the legs and under part of horses in the springtime, the animals will be much more comfortable while working. Mud, which would become incrusted in the long shedding hair of an unclipped horse, can easily be brushed from the clipped animal, while the top coat is sufficient protection from chilly winds and too rapid cooling after a working period. —C. M. Baker, Wooster, Ohio.

Small Platform Hung on Ladder Rungs Prevents Sore Feet or "Ladder Cramp"

Platform on Ladder Prevents Cramp

A small platform or board, about 10 by 15 in. in dimensions, attached to a ladder, as shown, by means of two ¼-in. iron rods, hooked to go over a rung, will give quick relief to any worker who is troubled with sore feet or "ladder cramp." To prevent splitting, strips should be nailed or screwed to the bottom, as shown. The rods should be about 26 in. long, threaded for at least 2 in., and each one should be provided with two nuts and two washers.

Removing Paint Residue

Paint residue often collects under the edge of friction-top cans having a rim. This can easily be removed with the scraper shown in the illustration. It is cut from a piece of sheet iron to the shape shown and a hole is punched through it to permit hanging it up. It should be made of fairly stiff stock and then it can be used also to remove the covers.

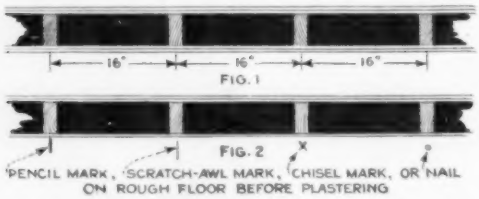
Street Intersections Marked with Old Auto Rims Filled with Concrete

Old Auto Rims Serve as Crossing Markers

In one small Texas town, every street intersection is marked with an old auto rim filled with concrete. Obviously their cost is small compared to that of specially made markers, and autoists will take care not to ride over them for fear of damaging their tires.

Marking Location of Studding for Base Nailing

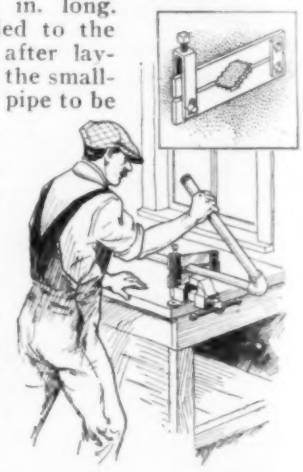
The illustration shows methods of locating the studding for base nailing, all of which are good, though some are better than the others. Fig. 1 illustrates how the studs are located by sounding, that is, by tapping the wall lightly with a hammer in order to ascertain the exact location by sound. This is the method quite commonly used. However, sounding for every stud is not necessary. When one stud has been located, the others can be found by measurement in the manner illustrated. Fig. 2 shows another commonly used method. Here the location of each stud is marked before the plastering is done. The mark is placed directly in front of the center of the stud, on the rough floor, with a dark crayon or a heavy lead pencil. A scratch awl, too, will give good results or the marking can be done with a wood chisel. If the chisel is somewhat dull, the marks will show up better. A lath nail, or other small nail, can also be used for the purpose, driving it about 2 in. from each stud and leaving the head slightly projecting above the floor, so that it can be seen and pulled easily.—H. H. Siegele, Emporia, Kans.



Several Methods of Marking Location of Studs to Permit Easy Attachment of Baseboards

Homemade Pipe Vise Easily Made and Carried

The pipe vise shown in the drawing can easily be carried from one job to another, and can readily be made by anyone with little labor and at small expense. The clamping bars are made from 1¼ by ¾-in. flat steel, 6¼ in. long. The jaw is filed to the shape shown, after laying out to take the smallest and largest pipe to be handled. With the stock size given above, the largest pipe that can be handled is the 1½-in. size. The two clamping bars are held together by 1 by ⅜-in. bars and ½-in. pins, the latter being secured by ⅛-in. cotter pins. A piece of 1 by ½-in. flat steel is bent to fit over the clamping bars and is fastened to the bottom bar with a ½-in. pin, which is also held in position with cotters. The top of the U-strap is tapped for a standard ½-in. bolt of the proper length to take in the range of pipe sizes. Two holes, ¼ or ⅜ in. in diameter, are drilled in the bottom bar to enable one to fasten it to a post or table, or it can be used in a common vise. —Frank N. Coakley, Buffalo, N. Y.



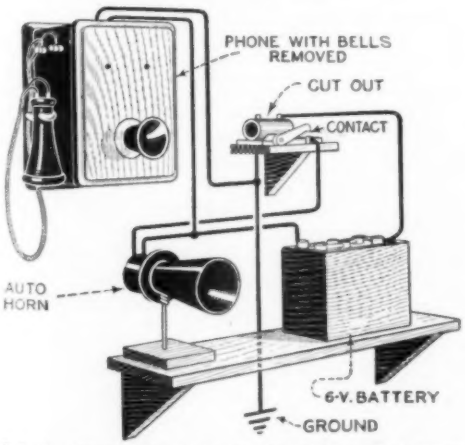
¶A good cutting compound for drilling hardened steel is made by mixing sulphate of copper, 1 oz.; alum, ¼ oz.; salt, ½ teaspoonful; vinegar, 1 gill, and nitric acid, 20 drops.

Quieting Turbulent Water

Wave disturbances, or other turbulent water-surface conditions, which accompany the high velocities existing in stream channels below overflow dams, spillways, drops, etc., can be broken up and entirely eliminated, by the use of brush baffles. Large branches of trees, or even whole trees in the case of the larger streams, are cut and placed in the channels, where they are held in place by steel cables run to suitable anchorages. The smaller pulsations in flow, which cannot be damped by symmetrical baffles, because of their regularity, are entirely eliminated by the irregular brush obstructions.

A Telephone That "Honks"

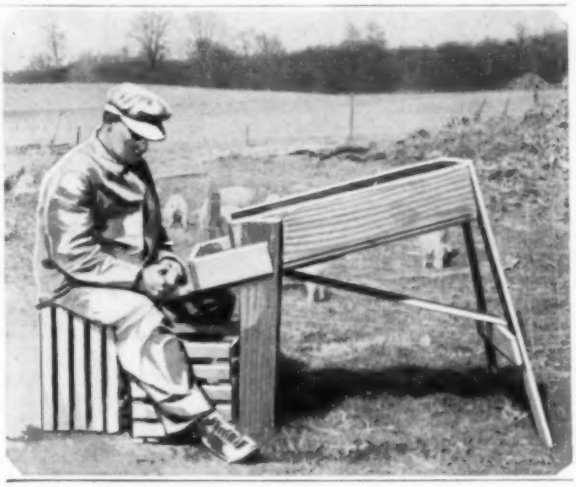
A telephone that honks can be used to advantage in shops where noise prevents the ordinary ringing apparatus from being heard. To make this change on an ordinary telephone the following materials are required: A Ford cutout, a 6-volt battery, a Ford horn of the battery type and pieces of wire. Disconnect the wires leading to the ringer magnets of the telephone and connect them to the cutout, as shown in the diagram. The spring tension of the cutout points should be lessened. When the circuit is closed at the telephone exchange, the cutout is closed, which in turn closes the battery circuit to the horn and causes it to sound. —Mabel Ellis, Richland, Mo.



Substituting an Auto Horn for the Telephone Bell When Loud Signals Are Desired

Cutting Seed Potatoes

To cut seed potatoes rapidly, a box designed to allow the tubers to roll closely onto the operator's hands is used as shown in the accompanying photograph. The potatoes are cut so that each piece contains one or more eyes. Thus each tuber must be handled and cut several times. The sloping box allows the spuds to be examined and selected easily for rapid cutting.



Cutting Seed Potatoes Rapidly with the Aid of an Inclined Box Which Facilitates Handling Them

Tumble Weeds Burned in Wire Cages

One irrigation district has found that the tumble weeds and miscellaneous debris which collect in the canals at checks, turnouts, bridges, and other irrigation structures, and which must be removed almost daily in order to keep the canals open, can best be disposed of by drying and burning them in huge woven-wire cages. This prevents the weeds from causing further annoyance by being blown back into the ditches or on adjacent farm lands. The cages are placed along the canals at points where the debris collects, and the wet weeds deposited in the cages one day are allowed to dry until the next cleaning, then burned just before the new accumulations of wet material are removed from the canals.

¶When using a reamer or tap that is too small, cut a narrow strip of tin and bend it over one or more of the teeth to make them take a larger bite. The same idea will work on a pipe or bolt die.

Combined Micrometer and Work Holder

Micrometer holders are handy for many kinds of measuring work, and the one shown in the illustration has an added feature that makes it doubly useful. It consists of a small table whereon the work can be laid. The body of the holder is made from a piece of 1/16-in. sheet metal, bent and cut to the shape indicated. Two large washers, a screw and wingnut, working in a slot in the body, complete the device. The holder is made for use when batches of parts are to be tested. The micrometer is located in the holder in a position that will bring the measuring faces in the center of the work, and the clamping fixture is moved up or down as required to fasten it. Thus, it is only necessary to lay the work on the table on which it is at once located centrally and squarely, making a true measurement certain.—Harry Moore, Montreal, Can.

Work Holder for Micrometer Doubles Its Usefulness

Homemade Elevator Wings

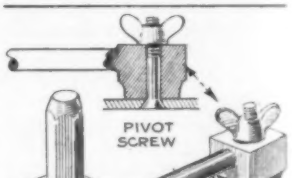
Wings of a grain elevator loosen quite readily and many of them are lost entirely during a season's run after the third year unless they are overhauled every year. We did not realize this fact until we removed the chain and wings and were surprised to find sixteen of the wings gone. We had but six new ones, so we took a piece of No. 16 gauge sheet metal—the heaviest on hand—and with a compass marked the circles, which were cut out with a 1/2-in. cold chisel, using a piece of casting with a flat surface to cut on. On cutting through the sheet, the chisel turns down the edge so that, when the wing is completed, it is strengthened considerably by this upturned edge. A washer was placed on the head of the rivet, and we found that these wings, although thinner than the old ones, were just as good.—G. McVicker, North Bend, Nebr.

Marking Triangles for Identification

Many draftsmen lose triangles simply because they have no identification mark on them. A simple but effective method of marking them is as follows: Obtain a heavy writing pen with a new point, and after dipping it in a solution of anhydrous acetic acid, you will be able to write your signature on the surface of the triangle neatly. A little black ink can be added to the solution if you wish the mark to show very plainly. The use of acid alone gives the same effect as if the surface had been sand-blasted.—L. H. Georger, Buffalo, New York.

Cutting Circular Holes in Plate

In boiler making and allied trades circular holes of large diameters must often be cut in heavy plate. This is usually done by first scribing a circle of proper diameter and then chiseling by hand or cutting with an acetylene torch. Where the latter method is not available the work of chiseling can be made much easier by using the tool shown in the illustration. It is a combination of a compass and a holder for the chisel so that the latter can be guided in a circular path with practically no danger of striking the hand with the hammer. The parts are a center block, a length of 1/2-in. iron rod welded to the side of this block and a movable tool holder slipped on the arm and held at any point by means of a small setscrew. In use, a small hole is drilled in the exact center of the hole to be cut, and the screw in the center block is slipped through from the underside and tightened, but not too much, since the center block should turn freely.

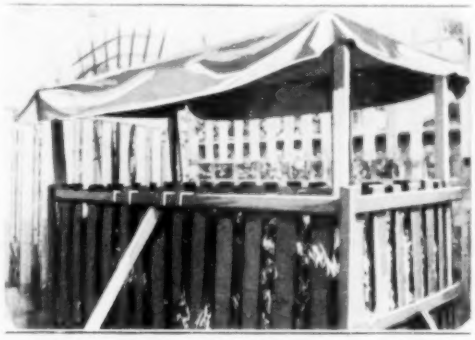


Tapping Collets

We had 50 large-sized collets with a ¾-in. threaded hole in the shank end. The hole was hardened and ground and it was then discovered that the thread gauge would not enter. They could not be annealed for fear of spoiling them, so I gave them a coat of oil on the ground surface and cleaned all the dirt out of the threaded hole. The collets had a small part of a drift-key hole break into the threaded hole and I plugged this opening with wax. I then placed the collets on the bench, with the threaded hole up, and poured strong muriatic acid into each hole and let it eat for about five minutes. I cleaned out each threaded hole with hot soda water, to neutralize the acid, and then found that the thread gauge fitted nicely. Acid will not eat the wax. The tap used for finish-sizing on these collets was just a couple of thousandths, or so, small. We have applied the same method on the railroad to eat through a hard scale in order to be able to drill a hole that could not at first be started.—W. L. Miles, Warren, Rhode Island.

Making Potato Hills Pay

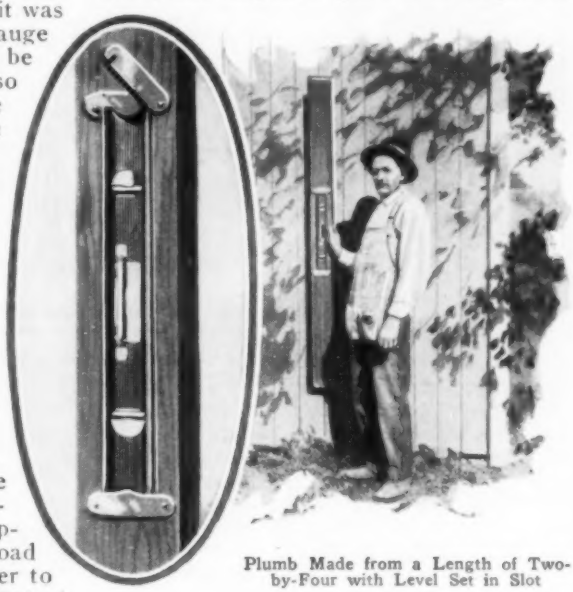
Forty-two bushels of good potatoes were successfully harvested from a crate bin, 8 ft. long, 6 ft. wide and 6 ft. high built of 4-in. boards, ½ in. thick, leaving 2½ in. space between the boards. To keep the dirt from sifting out, the bin was lined inside with coarse straw and then filled with alternate layers of manure and soil. The potatoes were planted 1 ft. apart each way, two eyes to a hill, the top layer sloping to the center to prevent water from running off. To make it possible to test the moisture in the soil, a piece of timber, about the size of a man's arm, is put into the center of the bin, halfway down, leaving 1 ft. protruding above the dirt. The moisture condition can be determined by removing the timber and inserting the hand. This should be done each week. —A. I. Hunt, Pasadena, Calif.



An 8-Ft. Bin from Which 42 Bu. of Good Potatoes Were Harvested in One Season

Improvised Carpenters' Plumb

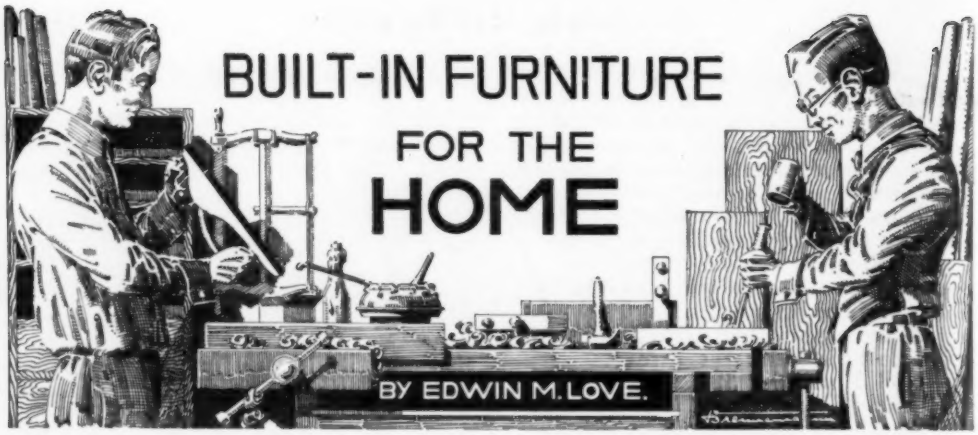
For an ordinary level as a plumb on walls, one carpenter got a 5-ft. length of 2 by 4-in. stock, smoothed it on four sides and cut a slot out of the center to accommodate the level. Small metal links, pivoted to the wood at both ends of the slot, hold the level in place securely.—R. M. Singer, Chicago.



Plumb Made from a Length of Two-by-Four with Level Set in Slot

Repairing an Air Compressor

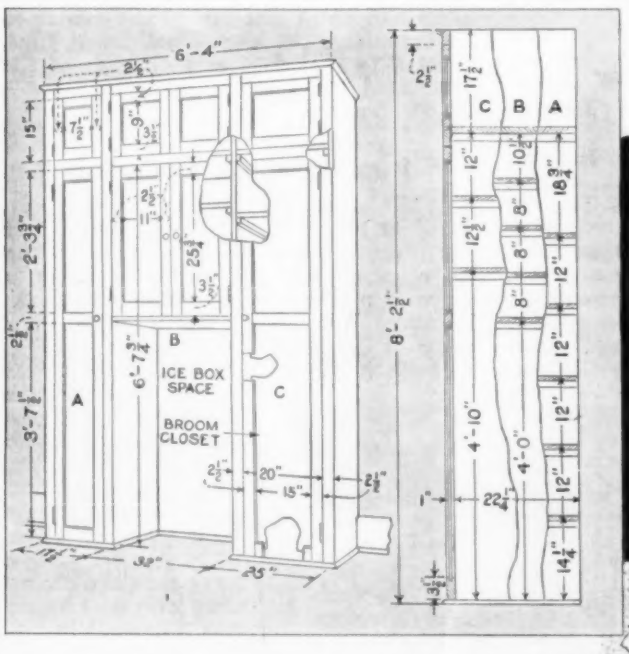
While repairing an air compressor, rated at about 75 lb., it was found that the pressure hose was unserviceable. As no other pressure hose was available, a piece of ordinary rubber tubing was taken and rolled, for its entire length, in a piece of 2½-in. adhesive plaster, such as is sold at all drug stores; then it was bound again with a narrow strip of the same plaster, but laid on a bias to prevent the lengthwise strip from loosening. As both ends of this improvised hose were clamped to connections, there was no possibility of its unraveling, and when completed, the hose withstood 100 lb. of pressure.—F. St. Boulanger, Alexandria, La.



Part XVIII—Laundry-Porch Furnishings

IN the laundry porch there is usually wall space for shelves, and frequently unoccupied space about the icebox that can be put to use. The wall cabinet illustrated provides considerable shelf space, which, being hidden by doors, need not give the cabinet the appearance of a catch-all; and at the right is a closet for brooms, mops and a vacuum sweeper.

The two ends and two partitions are glued up of 1 by 12-in. by 10-ft. stock, the back for the ends. The left partition line is 1 ft. 5½ in. from the left end, and the other 2 ft. 8 in. from that. Square up the bottom shelves, making one 1 ft. 4 in. long, and the other 2 ft. 1 in., and both 2 ft. 3¼ in. wide, deducting the thickness of the baseboard from this, if the latter is already in place. Nail these shelves in position on the floor, so that their ends will form backing for the bottoms of the partitions and end boards. On the wall plumb lines from the bottom shelves as guides in putting up the vertical divisions of the cabinet. Level lines for the tops of the shelf



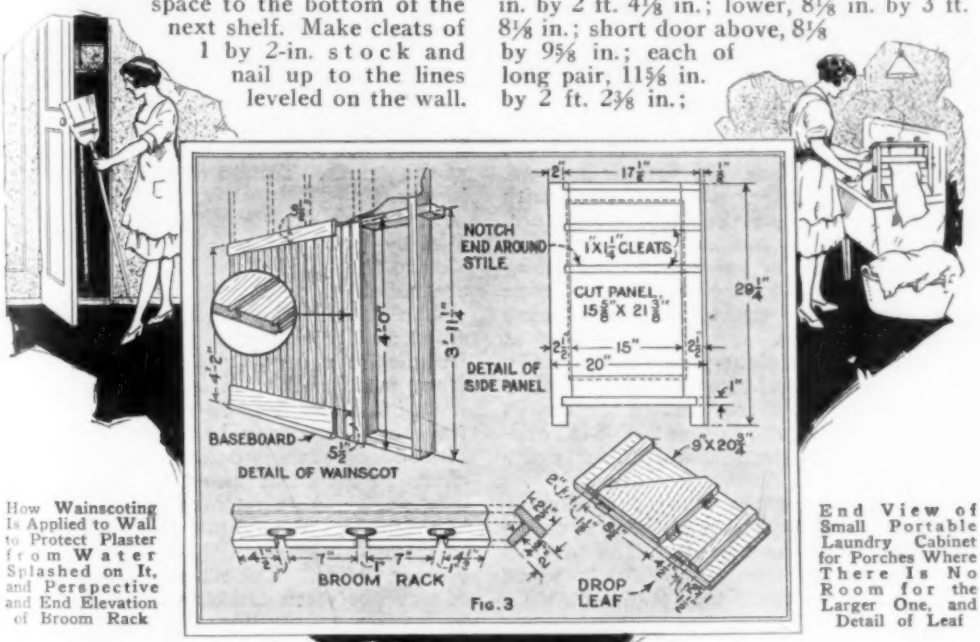
Perspective of Laundry-Porch Cabinet, and Sections through the Compartments

scraps making four shelves for the left compartment. Cut the longer shelves from 1 by 12-in. by 14-ft. material. On the floor, 1 ft. 11¼ in. from the plaster, draw a line 6 ft. 4 in. long, and square

cleats in the left space, starting 1 ft. 2¼ in. from the top of the floor shelf, and ranging the next four successively 1 ft. apart. The fifth is 6 ft. 10⅝ in. above the floor.

In the middle space, the bottom shelf is 4 ft. from the floor and the next three are spaced 8 in. bottom to bottom. The upper shelf lines with the other two. The lowest shelf in the broom closet is 4 ft. 10 in. from the floor to the bottom; the next is 12⅝ in. above, leaving a 12-in. space to the bottom of the next shelf. Make cleats of 1 by 2-in. stock and nail up to the lines leveled on the wall.

below the tops of the shelves, making doorstops. The stiles and upper rails of the door are of 1⅛ by 3-in. stock, sized to 2½ in. in width, with exception of the lock stiles of the left doors of the two pairs, which are finished 3 in. wide, the ½-in. rabbet giving an outside width of 2½ in. The lower rails are of 1⅛ by 4-in. stock. Make the panels of ⅜-in. three-ply fir on pine veneer, cutting them to the following sizes: Long door at left, upper panel, 8⅛ in. by 2 ft. 4⅛ in.; lower, 8⅛ in. by 3 ft. 8⅛ in.; short door above, 8⅛ by 9⅝ in.; each of long pair, 11⅝ in. by 2 ft. 2⅜ in.;



How Wainscoting Is Applied to Wall to Protect Plaster from Water Splashed on It, and Perspective and End Elevation of Broom Rack

End View of Small Portable Laundry Cabinet for Porches Where There Is No Room for the Larger One, and Detail of Leaf

Stand the ends and partitions in place, plumb the front edge and scribe to the walls, keeping all front edges in line. Mark the shelf positions and square from the front edges, nailing on cleats of 1 by 2-in. material, which have previously had the lower inside corner chamfered off. Do not glue, as shrinkage of the boards will open their joints or check them.

Nail up the sides and partitions to their wall cleats, using six-penny finish nails driven into the ends of the cleats, or eight-penny toenailed into studding where such are conveniently spaced. The bottom shelf comes flush with the front of the cabinet.

Glue and nail to the ends and partitions stiles of 1⅛ in. by 3-in. stock, sized to 2½ in. in width, and cut the upper rails and ceiling rails between. The lower edges of the upper rail are 6 ft. 8½ in. above the floor, so that the upper edges are ¼ in.

doors above, 11⅝ by 9⅝ in.; door of broom closet, upper panel, 1 ft. 3⅝ in. by 2 ft. 4⅜ in.; long panel, 1 ft. 3⅝ in. by 3 ft. 8⅛ in.; door above, 1 ft. 3⅝ in. by 9⅝ inches.

To make the broom and mop rack, cut a back cleat of 1 by 3-in. stock, chamfered on the edges, and to the center of the face nail the 2-in. strip with the grips for the brooms. The latter are made by boring 1-in. holes with the centers spaced 8 in. apart, cutting a section 1 in. long from the stock in front and chiseling straight the stock behind, and chamfering the edges.

Because of the likelihood of water being splashed about on the laundry porch, some form of wainscot to protect the plaster near the floor is desirable. This may consist simply of well enameled plaster, or plaster covered with oilcloth, with a plain wooden band or cap run around the walls 4 ft. from the floor, or the plas-

ter may be removed and 1-in. ceiling put in its place. The drawings illustrate a method of doing this. Take up the baseboard and shoe, and pull the nails out from the back with pliers to avoid marring the front. Four feet from the floor, level a line around the room and remove the plaster and lath below it. Between the studs, with the edge of the plaster as a guide for their tops, nail 2 by 4-in. trimming blocks. Cut 4-ft. lengths of V-groove pine ceiling and nail up vertically, driving them closely together, and end, nailing into the blocks and the bottom plates. Plumb often, for pieces cut from the end of a stock length are often wider at the freshly cut end than at the other, due to shrinkage, and will tend to make the joints "run" at the top or bottom. If desired, the edges may be coated with white lead to help make them waterproof.

Refit the baseboard and shoe, replacing broken lengths, or splicing on a stud by mitering. Use ⅝ by 4-in. round-edge wainscot cap for the upper band, coping the corner joints, and double-nailing at every stud with eight-penny finish nails. If the ceiling is thicker or thinner than the plaster, rabbet the back of the cap to suit. To figure the amount of 6-in. ceiling required, allow five widths for every 22 inches.

In laundry porches where a stationary cabinet is impossible, the little portable one illustrated has its uses. The top has a drop leaf on each end, which, when lifted, make a worktable, 1 ft. 8¾ in. wide by 5 ft. 7½ in. long.

Glue up the top and shelves of 1 by 10-in. stock. Then build the two sides like panel doors, using 1⅛ by 2½-in. stock for the stiles and upper rails, and 1⅛ by 4-in. stock for the lower rails. The panels are 1 ft. 8 in. in width and 2 ft. 2¾ in. long, with the stiles projecting below the bottom rails 2½ in., these being ripped to 1½ in. in width for this distance, to form legs. Using ⅜-in. three-ply panel veneer, cut panels 1 ft. 3⅝ in. by 1 ft. 9⅝ in. Rip 1⅛ by 3-in. stock in the center to make drawer-slide cleats, and cut three for each side to a length of 1 ft. 5½ in. Glue and nail one at the top of each side, inside, the back ends ½ in. from the edges of the panels and the front ends 2 in. from the front edges. The others are spaced 4⅛ in. apart, and are notched around the stiles so as to bear against the panel veneer. These must be square with the face edges of the panels. The bottom cleats are 1 in. longer.

The three drawer rails are of 1⅛ by 3-in. by 1 ft. 10-in. stock, edges out, doweled to the stiles of the sides and notched around the slide cleats.

The bottom shelf is fitted around the stiles and against the panel veneer, the front edge rising ¼ in. above the lower front rail for a doorstop. Nail or screw it to its cleats, but do not glue, though the front edge may be glued to its rail. If a second shelf is desired, install it with cleats in the same manner. For drawer side guides, glue narrow strips of wood between the stiles against the panel veneer to bring it flush with the stiles above the drawer cleats. Cut narrow ¼-in. strips of wood between cleats and shelves at the back, for nailing for the edges of the three-ply back, which is cut 1 ft. 10 in. by 2 ft. 1¾ in. It should be glued and nailed with four-penny finish nails. Attach the

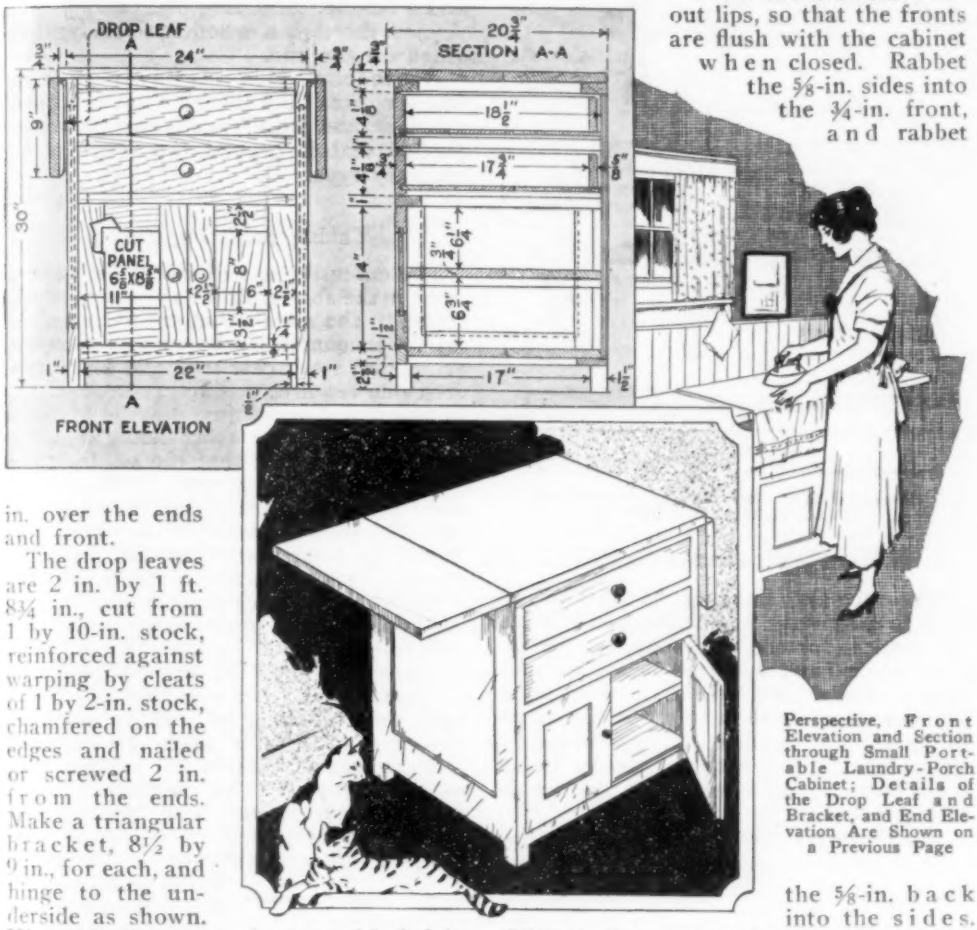
MATERIAL LIST

Stationary Cabinet	Portable Cabinet
1 piece, 1⅛ by 3 in. by 10 ft., pine or fir, S4S, sanded.	2 pieces, 1⅛ by 3 in. by 12 ft., pine or fir, S4S, sanded.
1 piece, 1⅛ by 3 in. by 12 ft., pine or fir, S4S, sanded.	2 pieces, 1⅛ by 3 in. by 14 ft., pine or fir, S4S, sanded.
2 pieces, 1⅛ by 3 in. by 14 ft., pine or fir, S4S, sanded.	1 piece, 1⅛ by 4 in. by 2 ft., pine or fir, S4S, sanded.
2 pieces, 1⅛ by 3 in. by 18 ft., pine or fir, S4S, sanded.	1 piece, 1 by 10 in. by 16 ft., pine or fir, S4S, sanded.
1 piece, 1⅛ by 4 in. by 8 ft., pine or fir, S4S, sanded.	1 piece, ⅜ in. by 2 by 8 ft., pine or fir, three-ply panel veneer.
8 pieces, 1 by 12 in. by 10 ft., pine or fir, S4S, sanded.	1 piece, 1 by 5 in. by 4 ft., pine or fir, S4S, drawer front.
6 pieces, 1 by 12 in. by 14 ft., pine or fir, S4S, sanded.	1 piece, ⅝ by 5 in. by 12 ft., pine or fir, S4S, drawer side.
4 pieces, 1 by 2 in. by 14 ft., pine or fir, S4S, sanded.	1 piece, ⅜ by 6 in. by 14 ft., pine or fir, T&G drawer bottom.
1 piece, ⅜ in. by 2 by 8 ft., three-ply, pine or fir, panel veneer.	2 pair, 2½ by 2½-in. loose-pin butts.
1 piece, ⅜ in. by 2 by 4 ft., three-ply, pine or fir, panel veneer.	2 pair, 1½ by 2½-in. hinges.
8 pair 2½ by 2½-in. loose-pin butts.	2 pair, 1½ by 2-in. hinges.
8 1⅛-in. glass drawer pulls (knobs).	4 1⅛-in. glass knobs.
8 forg catches. 2 elbow catches. Cost of materials, about $28. Time to build, about 30 hours.	1 elbow catch.
	1 forg catch.
	Cost of materials, about $8. Time to build, about 20 hours.

top with screws or nails from the underside of its cleats, giving a projection of ¾ in. over the ends and front.

The drop leaves are 2 in. by 1 ft. 8¾ in., cut from 1 by 10-in. stock, reinforced against warping by cleats of 1 by 2-in. stock, chamfered on the edges and nailed or screwed 2 in. from the ends. Make a triangular bracket, 8½ by 9 in., for each, and hinge to the underside as shown. Hinge the leaves to the top with 1½ by 2½-in. hinges, screwed on the underside. Where the brackets bear against the sides of the cabinet glue 5/16-in. strips to the veneer, to support the brackets full length.

Make the drawers without lips, so that the fronts are flush with the cabinet when closed. Rabbet the ⅝-in. sides into the ¾-in. front, and rabbet the ⅝-in. back into the sides. Slide the bottom into its grooves after the drawer is assembled. Build the doors of 1⅛-in. stock, making a rabbeted pair.

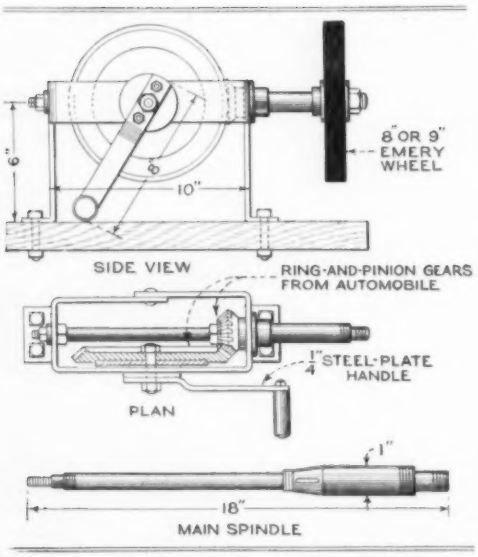


Perspective, Front Elevation and Section through Small Portable Laundry-Porch Cabinet; Details of the Drop Leaf and Bracket, and End Elevation Are Shown on a Previous Page

Guide Grooves for Hacksaw Blades

When using a power hacksaw for cutting short pieces of stock from large round bars, it often happens that the saw will not cut straight, with the result that the pieces are cut too short, unless a large amount has been left for finishing. This sometimes is due to the fact that the saw blade is not put on exactly square, which causes the set on one side of the teeth to wear off quicker than on the other side. A hard spot in the material will have the same effect. If a large number of short pieces are to be cut off, it is a good idea to mark the top of the bar with a chalkline, keeping the line always on top, and the pieces will all be cut at the same angle. An even better scheme is to first put the bar in a lathe and cut grooves in it about ¼ in. deep with a narrow cutting tool. The groove should be about 1/64 in. wider than that made by the saw blade. The pieces are cut off with a hacksaw, the grooves acting as guides. Care should be taken that the saw blade enters each groove freely.

¶Abrasion marks can be removed from a print by rubbing it with a tuft of cotton, dipped in alcohol and then rubbed over a cake of bon ami.



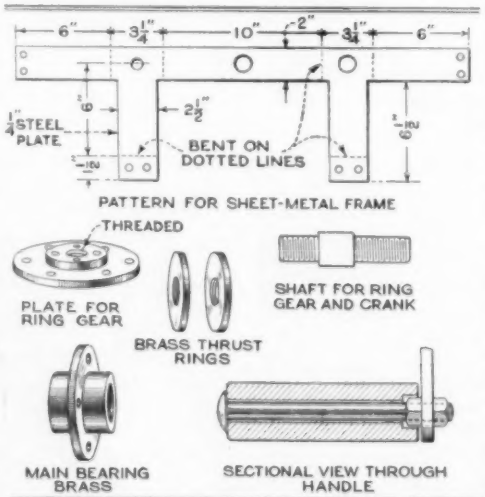
Side View and Plan of Mechanics' Bench Grinder Made from Old Automobile Parts

Grinder Made from Auto Parts

Discarded automobile parts can often be used to advantage in making useful tools and devices for the workshop, as, for instance, the hand-operated bench grinder shown in the drawings. It consists of a wooden base upon which the frame is mounted, and mechanism comprising a main spindle, the ring-and-pinion gears taken from an old automobile, and an 8-in. emery wheel.

The frame is made from a piece of ¼-in. steel plate, cut to the shape and dimensions shown. It is cut out flat according to the pattern, drilled at the points indicated and bent at right angles along the dotted lines. The legs are securely bolted to the base with ordinary machine bolts. The spindle is turned down and threaded for nuts at the points shown and fitted with main bearing and thrust rings, made of brass. The shaft for the ring gear and crank is turned down and threaded on both ends, so that nuts can be screwed on to hold the two parts in place. The crank is made of ¼-in. flat steel, cut and bent to the shape shown, and a handle, consisting of a carriage bolt slipped through a wooden sleeve, is provided on the end.

A grinder made in this way is larger and heavier than the usual type of bench grinders, and with it work can be accomplished that is beyond the range of the ordinary type.



Pattern of Frame and Details of Rings and Bearings

Making Soldering Fluxes

The extensive use of solder for general work in the shop calls for a variety of fluxes suited to the metals that are to be united. As the mechanic works with such metals as copper, steel, cast iron and aluminum, each one requires a different kind of flux in order that firm joints may be made.

The necessity for using fluxes in soldering lies in the fact that the oxide, which always forms to a greater or less extent upon all brightened metal surfaces, prevents the proper joining of the pieces. The fluxes, by removing the oxide, allow the solder to stick directly to the metal.

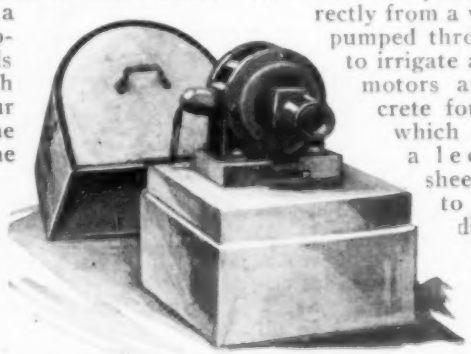
For soldering electric wires, commutator risers and other copper-soldering jobs, a flux should be used that will not corrode the metal as a result of electrolytic action. An excellent and easily used flux for this, as well as all other copper soldering, is made by carefully melting equal weights of vaseline and rosin together. The mixture is well stirred when melted, and poured into convenient containers. This flux, when cold, has the consistency of butter, so that a small particle of it will stick on the joint. As rosin varies in density, it may be found advisable to increase the amount used. Increasing the rosin will also result in a harder flux.

A liquid flux for copper electric wires is made by mixing 5 parts of a saturated solution of zinc chloride with 4 parts alcohol and 2 parts glycerin. The saturated zinc-chloride solution is obtained by filling a bottle half full of hydrochloric acid and then

adding small strips and cuttings of sheet zinc, a few at a time, until the acid will dissolve no more. Mix the alcohol and glycerin together and add to the zinc solution. The operation of dissolving the zinc in the acid should be done in the open air on account of the fumes that arise.

For uniting wrought iron and steel, a good flux is made by dissolving zinc in muriatic acid to saturation as described above; then diluting the mixture with twice its amount of water and adding a small lump of sal-ammoniac. The latter assists the solder to adhere, and in addition helps to prevent the soldering copper from corroding. The chemical action of this flux depends upon the fact that muriatic acid unites with iron and steel and in so doing deposits a film of zinc on the materials to which the solder will most readily adhere. In using any acid flux, all joints should be well washed and dried to prevent corrosion.

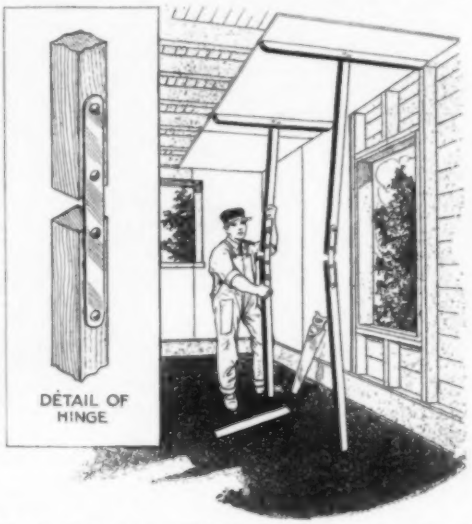
An excellent flux for steel parts, that will not blacken or rust the work, is made from 6 oz. of alcohol, 2 oz. of glycerin and 1 oz. of zinc oxide. Cast iron is a difficult metal to solder so as to make the parts hold, but this can be done easily by brightening both surfaces and coating them with copper. The coppering solution is made by dissolving a few crystals of copper sulphate in a small bottle of water, and is applied with a brush. Copper sulphate, like practically all other metallic salts, is poisonous when taken internally. Aluminum is a metal that offers the greatest difficulty in uniting it either to aluminum or to other metals. However, a solder prepared by melting together 84 parts tin, 16 parts aluminum and 3 parts of copper in the following manner, will be found quite satisfactory. Melt the copper first, add the aluminum a little at a time, stirring constantly with an iron rod; then add the tin and a small piece of tallow. Stand a dry, grooved board upright, stopping the ends of the grooves with wooden plugs and pour the hot metal into the grooves to mold the solder into sticks the thickness of lead pencils. Use an aluminum soldering iron. The flux is composed of equal parts of tallow and rosin; after melting, add half the quantity of zinc chloride.



Protecting Outdoor Electric Motors with Galvanized Sheet-Iron Covers

Fastening Plaster Board to Ceilings

A Wisconsin contractor, who builds many homes wherein plaster board is used, found great difficulty in supporting



Handy Supports for Holding Sheets of Plaster Board against the Ceiling While Nailing Them

without a helper the ceiling sheets for easy nailing until he devised the hinged T-supports shown in the illustration. Each support consists of a 4-ft. crosspiece and a 10-ft. standard. The latter is cut in two pieces joined with a stout spring, as shown. With these supports, one workman can raise a sheet of plaster board to the ceiling and wedge the board in place.

Protecting the Outdoor Motor

On a large country estate several electric motors are used to run pumps for filling and emptying a swimming pool. New water is pumped into the pool directly from a well. The old water is pumped through underground tile to irrigate a citrus orchard. The motors are mounted on concrete foundations the tops of which are recessed to form a ledge, and galvanized sheet-iron covers are made to fit on this ledge as indicated in the photo. It is claimed that the motors are as well protected from the weather as if they were inside, although they are uncovered when used.

Brush for Garage Washroom

A handy and efficient device for garages, machine shops and other shops where it is necessary to wash one's hands frequently,

Handy Brush Holder in Garage Facilitates Cleaning Hands and Keeps Brush Clean

is a handbrush supported on a bracket. A pair of ordinary handbrushes are mounted on a strip of flat iron, which is bent to clamp loosely around the water pipe at the back of the sink, as shown. The bracket should be long enough to bring the brushes under the faucet, and a band of heavy wire, drawn tight around the pipe below the iron, will support it at the desired height. In use, the brush is swung under the faucet so that the water flows directly on it. In this position, the workman can scour his hands more quickly and easily than is possible when the brush must be held in one hand, and the brush is always clean.—G. E. Hendrickson, Argyle, Wis.

Using Stained Lumber

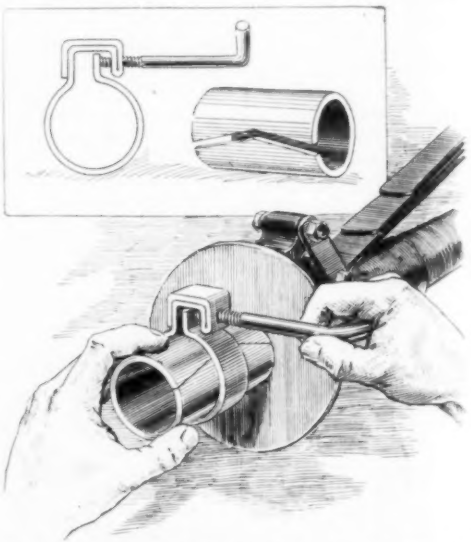
At times during the seasoning process small patches of stain may unavoidably develop in lumber. This discoloration is usually caused by a mold and is not an indication of decay. Numerous tests have shown that stained lumber is entirely satisfactory for painted or enameled woodwork. Lumber containing stains is always less expensive than bright stock, whether it is purchased in the grades admitting it, or in special "stained" grades. Money may be saved by using it in all painted work without lowering the quality of the finished product. Its use is recommended in many houses.

Drilling Rubber

We use rubber in the shop for strippers on punch-press tools, but have always had trouble in drilling smooth or accurate holes in it, until I hit on the following method: If the rubber is to be a tight or friction fit, use a "drill" the same diameter as the piece the rubber is to fit over; otherwise allow for clearance. The drill is a piece of thin tubing, beveled to a sharp edge, all the bevel being inside. Run the drill chuck at high speed with water as a lubricant. The hole will be smooth, and slightly smaller at the bottom than at the top. This method is only applicable to through holes and cannot be used for blind holes.—John A. Blaker, West Auburn, Mass.

Compressor for Split Sleeves

In shops where considerable repair work is done, a tool for compressing split sleeves, which are often used on roller bearings in axles, transmission and drive shafts, is almost a necessity. Such a tool can easily be made in a short time. It consists of a piece of flat iron or steel, bent to fit around the sleeves uncompressed. The ends are formed as indicated in the illustration, one being drilled and tapped

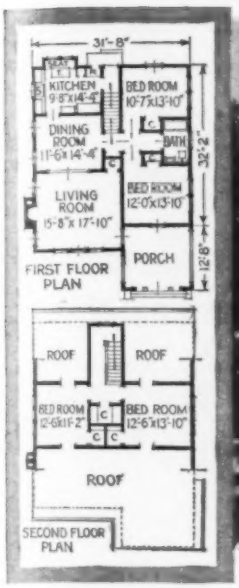


Compressor for Split Sleeves Made from a Piece of Flat Iron and a Screwhook

for a screw, which is used to tighten the device down on the sleeve to compress it.

¶It is dangerous to wear jewelry on your hands in a machine shop.

Two Extra Bedroom Bungalow



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Plan No. 5A59

QUESTIONS regarding home building addressed to this magazine will be answered by the Architects' Small House Service Bureau of the United States, Inc., controlled by the American Institute of Architects and indorsed by the department of commerce, United States government. Blueprints, specifications and material lists for the bungalow shown above may be obtained at a nominal cost. Inclose self-addressed stamped envelope for reply. If further information is desired send five cents and stamped envelope for a 24-page booklet explaining how the small home bureau functions and showing twelve sample plans.

A FEATURE of the five-room colonial bungalow illustrated here, is the opportunity to provide two extra bedrooms on the second floor, if desired. Dormers can be added to the front, thus furnishing cross ventilation for these bedrooms, or light for the storage space.

The house is of frame construction, with exterior finish of siding and shingle roof, concrete foundations and cement base course. The triple-arch Palladian-motif entrance to the porch is unusual.

On the first floor there is a living room, dining room, kitchen, dining alcove, two bedrooms, bath and porch. The number of closets is surprising, yet there is no waste of essential space.

The house is designed to face south or east, and can be reversed for the other facings.

A fireplace is a feature of the living room. An arched opening separates the dining room from the living quarters.

Home Builders' Questions

Q. We have a three-room house and are thinking of adding two more rooms and excavating underneath the whole house. Will this be more expensive than tearing down the whole building and making a new one? A. It will probably be less expensive to make an addition. The exact answer depends on the condition of the old house. If it is in good repair it would certainly be wise to save it. Do not start the work without an absolutely definite set of plans and specifications. Let the job to a good contractor.

Q. How do you find out how thick masonry walls for houses should be? A. City ordinances generally fix the limiting widths. If you have no such ordinance, write to the department of commerce, Washington, D. C., for their pamphlet entitled "Recommended Minimum Requirements for Small Dwelling Construction." Send 15 cents in coin for this. In any case follow the directions of your architect.

Q. Please tell me why we have to rewax our floors so often. They are of oak. They were filled and a little yellow stain was used with the filler. The wax seems to wear out very quickly though we use the best we can buy. A. This is unquestionably caused by the fact that you have not used a "sealing coat" to keep the stain from working up into the wax. There are special materials made for this. A coat of shellac does fairly well, but a coat of varnish is vastly better. Clean off the wax, put on a coat of varnish or shellac, then rewax, and you will have a permanent finish.

Q. We have a brick house. After every rain we have water stains underneath the window sills in our house. The paper comes off. I do not believe that there is any chance of this water coming in over the tops of the windows as these places have been examined and there does not seem to be any place for a leak. How can we correct this difficulty? A. The water probably comes in underneath the sills. This is caused by their not being properly imbedded in mortar, or not having other devices to form a water bar. A competent brick mason can probably remedy your trouble.

Q. The lower part of my house is finished in wide clapboards, having mitered corners that have pulled apart in a few places. What can I do to remedy this fault? A. It should be possible to bring these boards up tight with proper nailing. The joints should then be filled with putty and repainted.

THE PROOF OF THE PUDDING

This letter is to comment on your methods of publishing radio hookups. They are described in a very simple manner so that anyone can understand them. A friend of mine and I built the 3-tube low-loss set described in the Oct., 1925, issue. It was a success with us; the first station we heard was KOA, at Denver. It took us only three hours to build the set, and the following is a list of stations we heard on the first test: KOA, WBAP, WOC, KYW, KMA, WLW, WHT, WLIB, WDAF, WQJ, WJJD, WHO and WLS.

I think that is a fine start. We found out that the set tunes very sharp, and works well with either storage-battery tubes or the 199 dry-cell type; however, we obtained more volume with the large tubes.—Herman Eulitz and William Schraman, Maplewood, Mo.

* * *

I have finished the new 1926 model of the Superheterodyne described in the January, 1926, issue, and find a 1-meg. resistor in the first input clip of the amplifier unit is a decided improvement in my set. I now get Minneapolis at any time during the day. I also got the London, England, station during the International trials, and another station which I was not able to place. The balance of the week reception was poor for some reason and has been bad here for some time now.—Andrew Robbie, Cavalier, N. Dak.

* * *

Some time ago you gave me a suggestion as to reversing the connections on my condensers as they differed slightly from the ones you specified in the Perfect-Tone set described in the Nov., 1925, issue. If you remember, I was troubled with body capacity. I wish to advise you that it completely eliminated the interference as soon as done. I wish to thank you very much for the suggestion and assure you that now the set works wonderfully. It seems to use considerable B-battery voltage, but I can remedy that with a B-eliminator.—A. M. Augustine, Normal, Ill.

* * *

The Popular Mechanics Superheterodyne Eight receiver has the best tone and reception than I have ever heard in any radio set, and I have heard a great many. Mine is the 1925 model, and the 1926 should be superior to mine except that I added 50 volts more B-battery and put in the new power tube which gave me about the same results as the changes which you made in the new model.

Although I have not sat up at night trying to see how many stations I could get, I have, at the present time, recorded 88 and separated them just about as you state. For instance, Atlanta, Ga., a station at Cincinnati and another one I do not recall, are a distance of only 7 meters apart, all three of them, yet I have separated the three as well as getting a station at Boston, and one or two others which are on the same wavelengths. I have no trouble cutting out Buffalo, which is a powerful station, and getting KDKA at Pittsburgh, which are only 10 meters apart. I have received stations on wavelengths from 217 to 545 meters. My opinion is that I have a receiver second to none regardless of cost.—O. A. Statler, Hotel Statler, Buffalo, New York.

* * *

A few months ago I built one of your Popular Mechanics 8-tube Superheterodyne receivers. I am enjoying perfect satisfaction from this set.—R. Grelland, Chicago, Ill.

* * *

Nov. 25 you mailed me a blueprint No. 102 of the Perfect-Tone Six receiver. I followed it to a "T," so to speak, sent to Chicago for the "doughnut coils," used all of the parts called for and also used the Acme low-loss variable condensers. I did not stop for cost, but used the best parts I could find. I finished the set Sunday, put it on the aerial and do not find is necessary to change anything as the set is entitled to the name "Perfect." I spent last night getting onto the hang of operating it; there was a slight whistle, but I find I overcome this by turning down my detector tube so low that you would hardly know that it was lighted. Local stations were on and I plowed through them and got the World Battery Co., Chicago, about 7:45 p.m. I also got Decatur, Ill., Cleveland, Ohio, and New York City, all perfect.—Elmer F. Hornby, Pawtucket, R. I.

* * *

I have built the two-tube set described in the May, 1925, issue of Popular Mechanics Magazine, and am much pleased with it. The first station that I got was Denver, Colo., and I then logged 21 stations.—Floyd Hickok, Defiance, Ohio.

* * *

I am writing you again with reference to the Four-Tube Loop set described in the August, 1925, issue. I have built the set and have had wonderful reception on local stations; in fact, everyone who has heard it says that it is the best four-tube set they ever heard.—A. F. Hager, Buffalo, N. Y.

* * *

A short time ago I obtained a set of blueprints from your radio department and built the 1926 model of your superheterodyne. I have had nothing but the best results from this new model, and I am very well satisfied with it. Perhaps the results I have been getting are partly due to the superamplifier unit; at any rate I cannot conceive of a clearer or easier to operate receiver. I have built the complete machine in a glass case, ¾ in. thick. Being in the glass-cutting business, it was an easy matter to drill the holes. The cabinet is rather neat in appearance, and is somewhat of a novelty. —Eldon Simms, Detroit, Mich.

* * *

I built the three-tube set described in the September number of Popular Mechanics Magazine, and was successful in getting Cuba on the loud speaker very plain, while local stations were on the air. If anyone wants a good set at a low cost, I recommend that they build this set. The Cuban station I had was PWX.—Vernon Betle, Goose Lake, Iowa.

* * *

Your letter in regard to the trouble I had with my radio set received, and the instructions carried out. As soon as I put the 2-meg. resistor in the first input clip of the amplifier unit the set worked perfectly. I want to say that this not only cured the trouble in balancing the set, but it also made the set more selective than before.

Besides, I received stations that I never heard of before, with much more volume on all stations, and this was not due to good weather conditions, as the weather here has been terrible, with lots of static. I will say again that by following your directions, I have the best radio set I have ever heard, regardless of price, and when it comes to tone, there is none that can touch it. —K. H. Bolen, Anderson, Ind.

* * *

From May, 1925, with an average temperature of from 120 to 124° F., I heard very clearly on your 1925 Superheterodyne, almost better than I do now (in January) with the temperature at 105°. I have heard Chicago, New York, San Antonio, Mexico City, Buffalo, Pittsburgh, Cincinnati, Zion City and 11 other American stations.—Pochlin Peter, La Cieba, Sp. Honduras.

* * *

Here are the results of the B-T set built from your description in the October Popular Mechanics: Beginning at 7:45 p.m. Sunday evening, I tuned in 14 stations on the loud speaker. I am using UV-199 tubes, and compared with my other set, this is excellent. From Sunday to Thursday inclusive, I tuned in 56 stations, the farthest being San Antonio, Tex., 975 miles away. —Andrew Kostolnik, Jr., Louisville, Ky.

* * *

I have built the Super-Eight as described in the February and March, 1925, issues of your magazine. It has been working one week and I have had KFI already five nights, besides other Pacific-coast stations. I have had 116 stations to date.—Wesley Thomas, Little Falls, N. J.

IN accordance with the editorial policy of this magazine never to accept compensation in any form for what appears in our reading pages and also to avoid the appearance of doing so, we are obliged to omit the name of the maker or the seller of any article described. This information, however, is kept on file and will be furnished free, by addressing Bureau of Information, Popular Mechanics Magazine, Chicago. [Editor.]